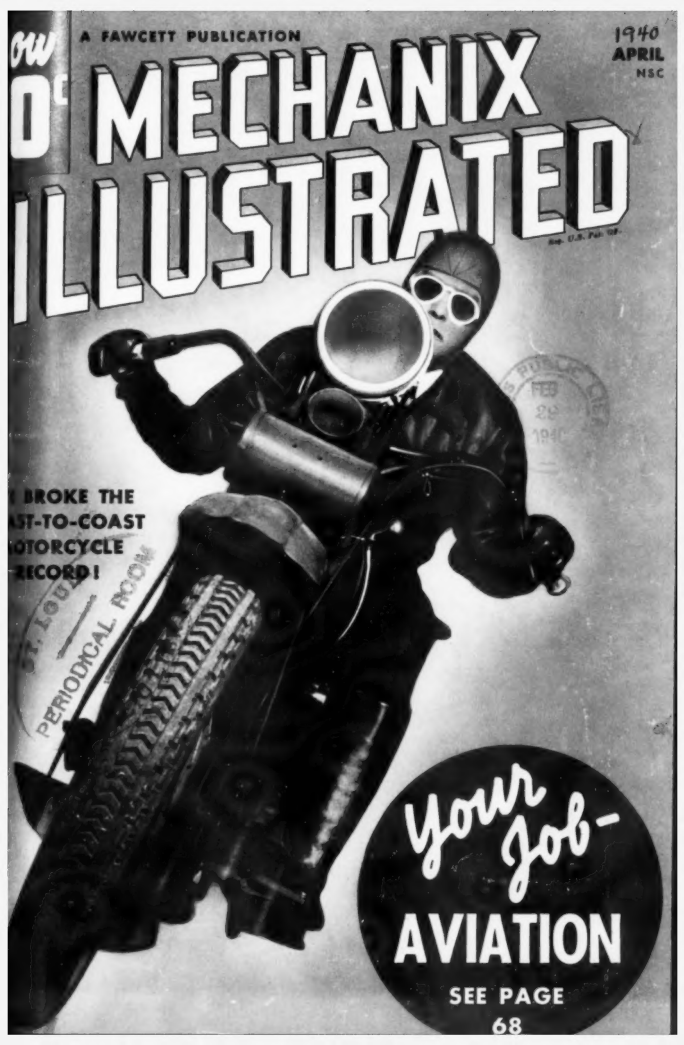
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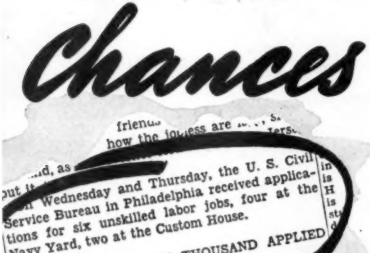

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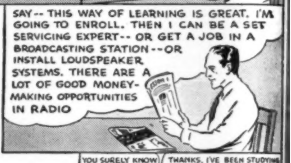

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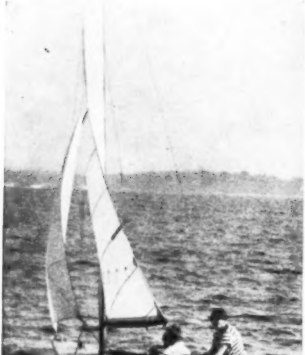
This is the indignant tone of many strong letters of protest we have received from air-minded young men all over the country since various agencies of the Federal Government decided that there weren't enough qualified aviators in the United States. The writers pointedly remark that a "sheepskin," to most of America's flying aces, is merely the lining of their monkey suits, and not a framed diploma on the wall. There are no fraternity pins, they add significantly, on the vests of Lindbergh, Chamberlain, Merrill, Acosta, Rickenbacker . . . to name only a few.

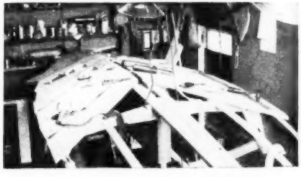
I sincerely sympathized with this attitude until I visited Washington recently and interviewed high-ranking officers of the Army and the Navy and officials of the CAA on the matter.

"Sure," they all said, in effect. "We realize that there undoubtedly are many 'natural born' fliers living in tenements and on farms, but the day is gone when a pilot can get by on mere nerve. During the adventurous period of ocean-hopping, in the '20's, many a hero was acclaimed for his ability to fly 'by the seat of his pants.' Today, a pilot is more of an engineer than an aviator. Merely pushing the controls is a small part of the job. He has to observe and interpret the readings of a dozen meters and gauges. He must know meteorology and navigation. He is constantly using an elaborate radio installation for blind flying, direction finding and air-to-ground communication. In a modern airliner the 'co-pilot' actually is the radio officer and does little piloting.

"We can teach any intelligent youngster to fly in a few weeks. But we can't take several years to give him a foundation in physics, mathematics and electricity. If an ambitious prospective pilot

[*Continued on page* 12]





Winner of the $5.00 prize for the best project pictures of the month is John Adam Palm, 282 Hutchinson Blvd., Mt. Vernon, N. Y. He writes:

"These pictures are of a 'Sun Ray Jr.', built in the spring of 1939 from the plans which appeared in the No. 4 issue of HOW TO BUILD 20 BOATS. This boat was sailed all summer in western Long Island Sound and the experience gained in building and sailing it gave me sufficient confidence to want to attempt a larger boat this year. I am now studying the plans of 'Jitterbug' and 'Pixie' in the new No. 5 edition of HOW TO BUILD 20 BOATS and will shortly make a decision and order the blueprints.

"I approached the building of 'Sun Ray Jr.' with some trepidation, never having built a boat before, but the plans and instructions were so thorough that I feel I can attempt something more complex with the assurance that your tested boat plans will prove their worth. I plan to make a photographic history of the construction of my next boat and will send you some of the outstanding picture sequences."

The picture to the left shows Mr. Palm's beautiful little ship under sail. The second photo (above) was taken while the boat was under construction in his home shop.

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Editor's Workbench Chips

[Continued from page 10]

"Perhaps you can find room in your department for these photos of the 'chip' I've been working on for the past year," writes Fred Kimball, of Menlo Park, Cal. "I designed and built this little sailplane from a description I obtained of a German ship. Toe dimensions are surprisingly small: span, 33 feet, chord 38 inches, overall length 16 feet, weight empty, 160 lbs. I graduated into this project after several years of building gas models. You can imagine what a thrill the first flight was! Besides myself, three friends have learned to fly it; one had never been in an airplane before. The whole thing set me back about $125, but I've had that much fun already."

For a "chip" as good as this one we always have room, Fred. A $3.00 award to you for the good pictures.

thinks a 'quadrant' is what firemen attach their hoses to . . . and we actually had such a case . . . can you imagine him in a plane trying to follow even the simplest type of radio beam?"

Well, boys, now you can see that flying isn't all snappy uniforms and pretty hostesses. Uncle Sam is willing . . . I should say anxious . . . to help you win your wings, but you've got to do your part too.

Incidentally, while we're on the subject of aviation, I'd like to mention that a new edition of the famous Fawcett FLYING MANUAL is now being prepared. Five previous editions achieved widespread popularity a few years ago, and we are bringing out another issue now because so many people have the itch to go aloft. It will feature, among other things, complete and up-to-the-minute dope on all government regulations relating to amateur and commercial flying. Containing 144 pages and hundreds of interesting photographs, the new FLYING MANUAL will be the biggest 50 cents worth of information, education and entertainment ever offered in the field. Look for it on your local newsstand around the middle of April.

[Continued on page 14]

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Editor's Workbench Chips

[*Continued from page 12*]

"I'm sending along a snapshot of a miniature car designed and built by my brother, Tyrus and John Frank, and myself. We used only Model "T" and "A" Ford parts, cutting down the axles, frame and steering gear so that the overall dimensions are about the same as a Bantam car. The wheelbase is 75" and the tread is 44". Only four welded joints and a couple of machining jobs were necessary in the entire construction.

"The car is very easy on gasoline, burning about a gallon to every 30 or 40 miles, depending on road conditions and the number of stops made. And it's weight is so low that even second-hand tires last indefinitely.

"Painted a bright red, trimmed with black, the car never fails to attract attention and admiration whenever we drive it. The usual question asked is whether the shortened wheelbase and tread make it hard to handle. It has no tricks whatever, and holds the road perfectly at all speeds, because we were careful to see that the front axle had the correct caster, camber and toe-in, and that the steering arms were set at the proper angle."

For this letter and the picture above, Manley Mills, of Royston, Ga., certainly rates a $3.00 prize.

Is My Face Red!

"I imagine that editors like to scold people," writes one of my "faithful readers," who prefers to remain anonymous. "Therefore, it is a pleasure to get back at 'em. On pages 20 and 21 of your February 1940 'Workbench' is what looks like a *lapsus typi setterorum* (boner, to you!). Either that or somebody's geography has slipped. You say—'everyone believed that the German air force . . . would rain death and destruction on Paris and Berlin.' That would be a happy solution of the war, but I know one guy who didn't believe it, and does not believe it now."

All right, "Berlin" should have read "London." But it's not a bad idea at that, eh?

***

Stretching Things a Bit

The tremendous technical achievements in the plastics industry, followed by popular public acceptance of numerous plastics products, have created no end of confusion in the minds of many people over the very term "plastics." They think the new "plastics" are "plastic," which they most emphatically are not. A lump of putty or a wad of well-masticated chewing gum is plastic, but the synthetic substances we call "plastics" are

[*Continued on page 16*]

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29x4.75-20	2.50	1.25
29x5.00-19	2.85	1.25
30x5.00-20	2.85	1.25
5.25-17	2.90	1.35
28x5.25-18	2.90	1.35
29x5.25-19	2.95	1.35
30x5.25-20	2.95	1.35
31x5.25-21	3.25	1.35
5.50-17	3.35	1.40
28x5.50-18	3.35	1.40
29x5.50-19	3.35	1.45
6.00-17	3.40	1.40
30x6.00-18	3.40	1.40
31x6.00-19	3.40	1.45
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33x4	2.95	1.25	33x5	3.75	1.75
34x4	3.25	1.35	36x5	3.95	1.75
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36x6	9.95	4.45			

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Editor's Workbench Chips

[*Continued from page 14*]

Writes Carlos Raynsford Filho, of Campos, Brazil: "Herewith I am sending you a photo of a brass chess set that I made as a gift for my older brother. The heads of the horses were cast, drilled and tapped, at the bottom, for fastening to the bases. The bases of the horses and all the other pieces were turned down on a lathe from round stock. The crowns of the kings and queens, the upper parts of the castles and the cuts in the bishops were made with the aid of a milling attachment. I spent about 110 hours of work on this project.

"The chess board itself was made from an old table over which were fitted 64 squares of metal, 3/32" thick, and over these, a piece of glass to protect them. The squares, instead of being black and white, are chrome and gold plated.

"My brother has already refused $60 for the game without the board. The amount in Brazilian money is equivalent to about $150 in American money."

plastic only during manufacture, when their ability to change their shape and to conform to molds makes them extremely valuable. Once the material "sets," it is rigid and solid; stronger, in fact, than many natural materials formerly used for the same purposes.

***

That Ray Is Here Again

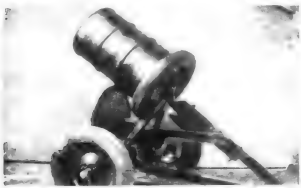
The current European war is proving exactly similar to the Spanish Civil War and the World War of 1914 in at least one respect. It has produced another fantastic "death ray" story! A Paris rumor reports the construction by the French government of a factory for the production of a "ray" machine that can bring down aircraft at tremendous distances by making their engines fail. The inventor is supposed to be a refugee Nazi scientist. So far, they say, only the inactivity of enemy aircraft has prevented a demonstration on the Western Front.

Hardly anything is "impossible" these days, but this story is pretty juvenile. During the Spanish War a number of Italian bombers were allegedly brought down by this same mysterious ray. Actually, however, captured pilots revealed that when they put their planes into long "silent" dives, for bombing operations, the rapid descent caused the spark plugs to cool off too suddenly, cracking them completely and naturally putting

[*Continued on page 18*]

Editor's Workbench Chips

Here are some more examples of readers' handicraft. Why not send in pictures of *your* projects?



Don't be alarmed! MI readers haven't gone in for howitzer construction, yet! This formidable looking machine is only an innocent cement mixer, made by P. R. Morlan, of Indianapolis, Ind., from an oil drum and old auto parts. The drum is turned at about 10 r. p. m. by a ¼ h.p. washing machine motor, geared down by a friction drive at a ratio of about 175 to 1. This is entirely a home workshop job, and therefore rates a $3.00 award.

For his careful workmanship in making the photoflash synchronizer described in PHOTOGRAPHY HANDBOOK No. 4, William Padgett, of Norfolk, Va., wins a $3.00 award.

"The unit cost only about one dollar, and works very well," he writes. "I used an ordinary doorbell for the release mechanism, as the original article recommended, and it does the trick perfectly."

This is probably the first midget racer in Columbia, S. C. It was built by Dr. S. L. Tabb of that city from plans for "Sp 'ree," which appeared in the August, 1939 issue of MI. (These plans are also printed in the current edition of MODEL BUILDERS' HANDBOOK.) The total cost was only $6.43, and of this the motor cost $3.00, the tires $1.00 and the front axle 43 cents. The rest of the material came from the junk box.

"The plans for this project, complete and detailed, made the construction easy and enjoyable," writes Dr. Tabb, who will receive a $3.00 check for his family snapshot.

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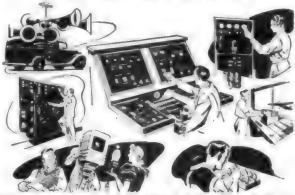

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Editor's Workbench Chips

[*Continued from page* 16]

the ships out of commission. Thereafter, they dived with partial throttle, and the trouble disappeared.

About a dozen years ago an English inventor with a fancy hyphenated name came to New York and caused quite a stir with his announcement of a death-ray machine that burned up anything it was aimed at within ten miles. The newspapers took it quite seriously until several cynical radio magazine editors called for a showdown. I was a member of that group and still recall the incident with a chuckle. At one of Mr. Double-Name's pompous press conferences a previously appointed representative of the group politely expressed our collective doubts as to his veracity, handed him a pickle jar containing a nest of fat, frantic cockroaches, and challenged him to turn his lethal machine on them from any distance up to three feet.

Mr. D.-N. hem and hawed, said something about the current in the hotel being of the wrong persuasion, and withdrew with as much dignity as the situation permitted. The cockroaches went down the drain, and that was the last anyone heard anything about Mr. D.-N.

***

When Speed Isn't

John L. Scherer, for several years aviation editor of MI and now co-pilot with Lieut. Comdr. Russel Holderman of a luxurious Lockheed 12 owned by Frank E. Gannett, Rochester newspaper publisher, came into the office recently to say

[*Continued on page* 19]

The article entitled "A Barbecue is Fun," which appeared in the July, 1939 issue of MI, appealed to Earle W. Leonard, of Los Angeles, Cal., because he had a lot of stones on hand and wanted to build something like it. He produced the combination barbecue-incinerator shown above, at a total cost of only $6.45. The structure stands 7½ feet high, the barbecue pit measuring 18x23 inches and the incinerator section 27x38 inches. For an excellent job of masonry, Earle earns an MI check for $3.00.

Editor's Workbench Chips

[*Continued from page 18*]

There's a reason for those pleasant smiles on the faces of Lieut. Comdr. Russel E. Holderman, U.S.N.R. (left), and John L. Scherer, pilots of the Gannett newspapers' Lockheed plane. They had just won second place in the annual New York-Miami air race by flying the 1,168 miles in 5 hours, 36 minutes and 1 second, which is fast traveling any time. Holderman is one of America's ace fliers, and Scherer, who is no slouch himself, was aviation editor of MI for several years.

hello to the staff and to relate some of his experiences. It seems he had just flown down from Rochester, dropped Mr. Gannett off at La Guardia Field, and then taken the plane over to Floyd Bennett Field, in Brooklyn, because there was no hangar space at the former airport. He then came into Manhattan by bus and subway. Nothing much exciting, of course. The interesting thing is this: Holderman and Scherer flew the 315 miles from Rochester to New York in *one hour and two minutes* (a stiff tail wind helped); it then took Scherer *one hour and ten minutes* to get from the Brooklyn field to Times Square, a mere matter of about 12 miles!

Air travel is a wonderful thing! Too bad our surface transportation isn't up to it.

***

Going Up!

Rotary winged aircraft of the autogiro or helicopter type will usher in the third stage of man's conquest of the air, according to the noted pilot and designer Igor I. Sikorsky. He forecasts

[*Continued on page 20*]

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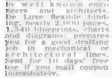

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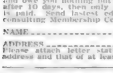

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Editor's Workbench Chips

[*Continued from page* 19]

a brilliant future for these planes, particularly in the field of private flying, to add to lighter-than-air and heavier-than-air transportation, the two earlier stages.

We earth-bound mortals earnestly hope that Mr. Sikorsky is a good prophet. Private flying hasn't been hindered so much by high cost of operation or lack of safety as by the requirement of long fields for take-offs and landings. Think of the thousands of pastures in the country that are open to rotary-wing planes capable of rising or descending slowly at sharp angles.

***

Ingenuity No End

About 100 years ago a commissioner of patents resigned his office, because he felt that human ingenuity had reached the ultimate and no other inventions were possible. He'd turn over in his grave if he knew that on the last day of 1939, the Patent Office granted patent No. 2,185,169, representing a total of 43,030 patents for 1939 alone.

Our patent system has long been criticized for certain weaknesses, but it does provide protection for both inventors and manufacturers. There is no better indication of their faith in it than the startling figures just quoted.

***

Surprise!

Don't be alarmed if your favorite radio stations are missing from their usual places on the dial one of these nights. You'll find them elsewhere, and you'll probably also hear some new stations. This shuffling will take place as a result of a

[*Continued on page* 21]

Patrolman Frank Houska, of the Detroit, Mich., police department, enjoys the hobby of transportation. Here he is with a faithful scale model of an 1873 locomotive and tender, made of wood. The engine is 8 by 20 inches and required three months of his spare time. The little coach on the left is another sample of his fine craftsmanship. A $3.00 check to Officer Frank for this interesting picture.

Editor's Workbench Chips

[*Continued from page 20*]

This is one of the neatest motor scooters we have seen in some time. It was built by Franklin H. Bartges, of Millheim, Pa., who wins a $5.00 award for these pictures. It is equipped with a one h.p. motor, has clutch and brake, weighs about 100 pounds, has a top speed of 25 m.p.h. and is sturdy enough to carry two 160 lb. persons. The chassis is an oak board reinforced with angle iron. The body is ½" plywood, and the fork is from an old bicycle frame. Must be lot of fun chugging around town on this chariot!

recent North American Broadcast Agreement, which has been ratified by Canada, Cuba, Haiti, Mexico and the United States. The treaty provides for allocation of the broadcast frequencies between 550 and 1600 kilocycles, and particularly those above 720 kilocycles. Its main objective is to distribute the frequencies so that interference is minimized, especially from highpowered stations in Mexico and Cuba that have no assigned frequencies of their own at the present time. On clear nights these stations, with their inevitable rhumba's, seep into receivers from Miami to Seattle.

***

No Fish Story

We've all heard of flying fish, and now we have submarine ducks. It has been demonstrated by Harry Leon Kutz, Cornell University zoologist, that black ducks can dive for food ten feet under! He dropped corn in water at depths of five, seven and ten feet, and observed that they competed successively for it with mallards at the two shallower depths and monopolized it at the ten foot level.

Maybe the British can train a flock of these high divers to bomb German submarines! If that sounds crazy, remember that seals were actually tried during the last war for the same purpose that dogs are used in hunting; that is, to flush the game!

***

Money for Pictures

You don't have to be an expert photographer to win one of our cash awards for pictures of home workshop projects. A good snapshot made with the family's Kodak will serve the purpose. Glossy prints are preferred—*Robert Hertzberg, Editor.*

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Dear Mac: Please forward me your catalog. I want it to add to my traveling souvenirs. I am working in a modern garage although I have been out of school only four weeks, thanks to McSweeny Training. My best regards to all.—M. Klushauk

Rector, Ark.

Dear Mac: Just a few lines which might interest you. I left your school two years ago last May. Since I left I have not been at a loss I could call "Hard Times". I have been working ever since I left and have averaged in my earnings $173.00 a month in spite of the hard times. Many thanks.—Thos. J. Sharp

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We've just read that Pennsylvania's Dental Society will hold its 1940 convention aboard a steamer on the Great Lakes.

And as the boat, packed with tooth-pullers, starts out, the band on the dock will undoubtedly give it a good send-off with a stirring rendition of that great tune: "Yankers Away!"

* * *

A recent survey informs us that about 18 per cent of the accidents in the home occur in the kitchen. "The result of hurry, usually," the bulletin says, "Or using makeshift tools."

Well, the rolling pin may be a makeshift tool, but show us anything else that would keep the average that high!

[*Continued on page* 23]

By G. d'Alessio

"You didn't come a moment too soon. We're running low on that supersensitive panchromatic film."

Through The Periscope

[*Continued from page 22*]

By Jimmy Cahorn

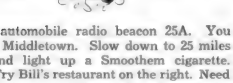
"All I can pick up is the whirring sound of a rubber band—must be a model plane!"

* * *

Archeologists have discovered that putting raw meat on a black eye was an old Egyptian remedy.

Reading this, we can practically hear the unlucky fellow telling his friends about it the next morning. "So help me, fellows, I bumped into a Pyramid in the dark!"

* * *



"This is automobile radio beacon 25A. You are now in Middletown. Slow down to 25 miles an hour and light up a Smoothem cigarette. Hungry? Try Bill's restaurant on the right. Need an aspirin? Get it at Wilson's drug store on the left. If you want real comfort, Kelly's hotel is just around the corner. This is automobile radio beacon 25A. Have you tried. . . ." Bulletins like that may be picked up by auto radios as soon as advertisers start financing roadside transmitters, Dr. Orestes Caldwell, radio authority, predicted in a recent speech.

Maybe we're old-fashioned and a puddle in the path of progress, but we still think that music is about the best thing that comes out of a radio. When the advertisers *do* start this auto radio beacon stuff, look us up. We'll sell you a pretty good car radio—but cheap!

[*Continued on page 24*]

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WHIZ COMICS

Through The Periscope

[*Continued from page 23*]

In experimenting with monkeys recently, scientists at Columbia University, in New York, have discovered that monkeys, deprived of part of their brain, can still handle a rake with agility and undoubted reasoning.

We wonder how much of their brain would have to be missing to allow them to handle a gun intelligently and blow each other up?

* * *

By Irv Haaglund

"Good news, dear! I just invented a new explosive!"

* * *

Sometimes we think we can tell these scientists a thing or two. They say they know of absolutely no use for a wart hog's facial warts.

It seems mighty simple to us—how could the pigs live up to their names if they didn't have 'em?

[*Continued on page 26*]

By Don Ulsh

"That's the new entry from 'Tech.'"

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Through The Periscope

[Continued from page 24]

By Bob Ubh

"If you'd watch your spelling we wouldn't have to erase all the time!"

* * *

When automobiles were "young," one argument for thinking they never would amount to much was this: Horses could see at night, but the horseless carriage couldn't!

After looking over last year's accident rates, we're inclined to think that the old-timers had a pretty good point!

* * *

At a recent meeting of the Southern Medical Association, Dr. Bedford Shires, of Dallas, Texas, told of a method of desensitizing persons susceptible to ivy poisoning so that contact with the plant will mean nothing. The method consists in giving a "shock dose" of poison ivy oleoresin in gelatin capsules. For three to twelve days after swallowing these capsules, the patients have flare-ups of itching and eruptions. Tests show that patients so treated are immune to poison ivy, and regular inoculations will keep them that way.

Sounds fine, Doc, and our congratulations! But if it's all the same to you, we'll go right on the way we have been, and take our chances!

[Continued on page 27]

Through The Periscope

[*Continued from page 26*]

By Looey Graf

"I think I'll fix the hinge on the screen door, dear!"

* * *

Someone's always taking the romance out of life. We learned recently that all but one per cent of the machetes, those all-purpose knives used for hacking through jungles in Central America, are manufactured in Connecticut. Almost as cruel a blow as the time we were in Mexico City and bought some Mexican cigarettes to bring home as souvenirs. Five thousand miles we brought them, only to discover in very tiny letters at the bottom of the pack: "Made in Louisville, Kentucky."

* * *

All beekeepers get stung occasionally, says an expert on the subject. The secret of avoiding this, he continues, is to work with the bees on bright sunny days when they are busy, to work deliberately, and to protect your face with a good veil.

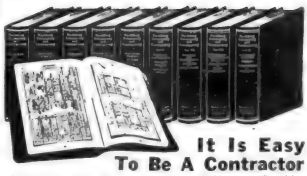
Or simpler yet, don't be a beekeeper!

* * *

A well-known physician recently announced that the mosquito was the most dangerous insect on earth.

What's the matter, hasn't he heard of Joe and Adolf?

—*Cliff Taylor*



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World Is Getting Warmer, Meteorologist Claims

The world is getting warmer. There appears to be a trend to higher temperature, J. B. Kincer of U. S. Weather Bureau, Washington, D. C., told the meeting of the Symposium on Temperature sponsored by the American Institute of Physics.

"That there have been major changes in geologic climate has long been known," said Mr. Kincer, "but climatologists have considered historic climate as a rather stable thing, with short period variations of considerable magnitude, but without especially secular trends covering long periods of time.

Mr. Kincer cited as examples the records at Portland, Oregon, where 17 of the past 20 years have been warmer than normal. And at Washington, D. C., 17 years in the last 20 have been warmer than normal and every year since 1926 above normal.

The world's lowest naturally-occurring temperature yet observed is minus 90.4 degrees Fahrenheit measured in Siberia in the month of February, 1892, Mr. Kincer said.

The highest temperatures ever recorded on the earth's surface was observed in Tripolitania in September, 1922, when the thermometer hit 1°3.4 degrees Fahrenheit.

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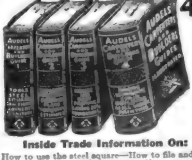

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It Keeps Your Hands Warm

Irritated by numb fingers from clinging to field glasses in the cold, this British Air Raid worker devised a novel idea of clipping his field glasses to his helmet with a piece of strong wire, thereby allowing him to scan the skies and keep his hands warm in his pockets. Horse racing enthusiasts might do well to copy—they could watch their favorite come in last and still have their hands free to tear up their hats in despair.

Rubber Used By Mayo Clinic To Make New Noses And Ears

Patients who have lost an ear or a nose because of cancer, other diseases, or accidents, can have new ones that defy detection made from latex, the pre-vulcanized liquid rubber of modern industry.

The new latex spare parts, necessary not only to restore the patient's appearance but to enable him to make a living, have been used on a number of patients at the Mayo Clinic. Dr. A. H. Bulbulian, director of the Museum of Hygiene and Medicine, has just reported to fellow physicians the details of his method of making these latex spare parts.

The new noses can be held in place either by spectacle frames to which they are attached, or by small quantities of a liquid adhesive solution. They may be used temporarily, until the plastic surgeon can make a new nose or ear from the patient's own and tissues, or they can be used permanently by patients whose age or financial condition makes plastic surgery inadvisable.

Ah, For The Good Old Days!

The girls seem to be amused over these relics of the "good old days" and small wonder—that one at the bottom looks more like a merry-go-round than a trolley, which was what it actually was. Only they didn't call them trolleys, then; they were horse-cars and street cars. These relics of days gone by are being exhibited to celebrate the new, streamlined trolley cars which were recently placed in service in San Francisco.

Take It Easy! It Costs Less!

While motor car manufacturers do everything possible to increase the gasoline mileage of their automobiles, the owner of the car, through proper driving, can also do plenty to decrease his gasoline consumption. In a report presented to a recent meeting of the Society of Automotive Engineers, the following driving test in Detroit was described.

A ten-mile course was laid through the city and the same car was driven over the route in two ways. First it was pushed to make the trip as fast as possible while keeping within a 30-mile-an-hour speed limit. All gears were used and speed was the watchword. It took 39 minutes to make the trip and the gasoline consumption was 3.5 miles to the gallon.

Next the same car was taken over the route using best driving practice—such as coasting up to stoplights in neutral, starting in second, accelerating slowly, etc.—which would give economy. It took 44 minutes to make the same trip this way. The mileage was 17 miles to the gallon!

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Pull Of Falling Weight Could Help Plane In Taking Off

As airplanes go to larger sizes aeronautical engineers are taxing their brains for ways to get them off the ground in a hurry while using existing airports. The alternative solution is to get longer runways; not always easy to do in settled communities.

Catapults, employed so successfully by the Navy to launch planes at sea, are all right for hardened pilots, but the terrific acceleration used would not be tolerated by passengers on commercial airline planes.

A variation of the idea, however, is the use of a heavy, dropped weight to assist in take-offs. To the Wright Brothers in their pioneer experiments goes credit for this suggestion.

F. R. Shanley and F. P. Cozzone of the Curtiss-Wright Technical Institute, suggest in Aero Digest that a deep well could be drilled in the centers of airports down which would be dropped a heavy weight that might have a mass of 50,000 pounds for the largest airliners.

The tug on a cable as it dropped would assist the airliner in its take-offs. Calculations show that a giant 65,000-pound airplane could take off in 1,000 feet with the help of a 10,000-pound weight. A 50,000-pound weight would cut the take-off distance to 500 feet, instead of 1965 feet for a plane of this type rising with its own power alone.

Hypnotism Called Impossible Unless Subject Believes In It

Hypnotism may disappear along with voodoo and hexing if a majority of the people believe it is impossible, is the suggestion voiced by Dr. Roy M. Dorcus, psychologist and expert on hypnotism at the Los Angeles campus of the University of California.

Experiments by Dr. Dorcus exploded the popular idea that a person hypnotized is at the mercy of the hypnotist because he must remain in a trance until the hypnotist awakens him. Assisting him were two graduate students, A. K. Brintnall and H. W. Case.

Twenty students were hypnotized. Then an assistant came into the room and reminded the experimenter of "an appointment down town." Replying that he would then be away the rest of the afternoon, the experimenter, followed by the assistant, left the room.

Did the hypnotized students lie there helpless until his return? Not a bit of it. They quickly got up from their cots and left the room, believing the experiment over for the day.

No awakening was necessary.

Other students placed in the same situation, except that they were not hypnotized, behaved in exactly the same way.

Coast Guard Canine Sends Off Planes

Here's an air-minded dog that earns his keep! "Slipstream," owned by Lieut. John Tighe, Coast Guard pilot stationed at Floyd Bennett Field, in New York, believes in working for his daily dog biscuits. He has appointed himself official "chock-puller" at the Coast Guard Airbase. As soon as "Slipstream" hears an airplane motor bark into life, he immediately runs over and tugs the chocks away from the wheels so that the plane can taxi out for a take-off. Lieut. Tighe has trained "Slipstream" to wait until the engines are thoroughly warmed up, and to wait for a signal from the pilot before pulling away the chocks.

Red Light Lures Moths, Ultraviolet Kills Them

Because a friend happened to mention that the neon sign on the corner of a downtown hotel killed a lot of moths, Professor Frederick K. Kirsten, of the University of Washington, devised his latest apparatus, an electric moth-killer.

The invention is simple, consisting of a metal cylinder containing a transformer and having on the outside two electric rings. The top ring is a red-glowing neon lamp and the lower one is filled with mercury vapor and gives a blue light, rich with invisible ultraviolet rays.

The red attracts the moths. As soon as they come near, the ultraviolet rays from the lower blue ring partially disintegrate them.

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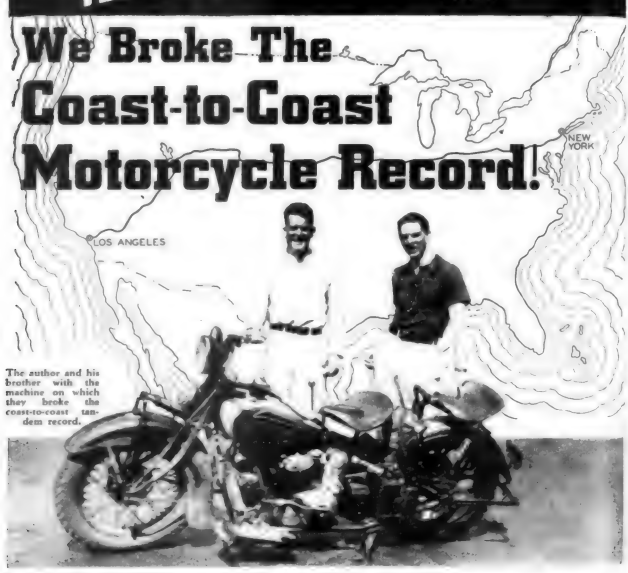
We Broke The Coast-to-Coast Motorcycle Record!



The author and his brother with the machine on which they broke the coast-to-coast tandem record.

OUR headlights bored into the black Utah night, dancing along the mountain road at seventy miles an hour. My brother Roger was at the handlebars of our coast-to-coast motorcycle and I had been dozing behind him on the tandem seat, lulled by the droning motor and the occasional sway of our two-wheeled steed.

Two a. m. and all was well . . . then suddenly I was aware of the glimmer of reflected light half a mile ahead. In a moment we could make out the glinting outlines of a dilapidated, headlightless car.

"Probably some cowboys on their way home," Roger shouted over his shoulder.

The jallopy was on its own side of the road, and we, bent on making time, slowed up hardly enough to waggle the speedometer needle. I was just getting ready to wave a passing salute as we shot by, when, without warning, the unexpected happened.

The cowboy driver, singing merrily and blithely, swerved right into our lane!

I felt the cycle lurch as Roger started to twist to the left. The jallopy turned, too. We swerved again, hoping to pass on the right, and the cowboys' car swerved with us. There was no time to stop. Ahead was either

Roaring across the country day and night on a two-wheeled "powerhouse" is no pastime for the faint-hearted. The author who, with his brother, smashed the tandem record for the grueling trip, gives you an idea of the thrills and chills involved.

by

C. Randolph Whiting

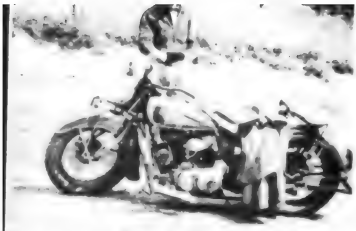
Above: The author and his wife plot out the course across the country. Left: C. Randolph Whiting behind the headlight of the machine on which he and his brother broke the record. Below: The author on an early model cycle on which he broke the solo record from coast-to-coast in 1934.

a horrible head-on crash . . . or the ditch.

We chose the ditch, and at almost a mile a minute bounced along the dry gravel of the shoulder on the side of the road, holding our breaths. The boisterous, laughing cowboys added a comic touch with their screaming "Hya's" as we swerved by them. We left them to their macabre jokes and kept roaring on toward California.

Keeping going was the main secret in our thrilling adventure of storming the New York to California motorcycle record . . . a record that had stood from the days of "Cannonball" Baker, nearly twenty years ago, until 1934, when I had shattered it "solo." Now my brother and I were out to top my own solo time and incidentally hang up a new mark for two on a cycle.

I'd been preparing a long time for this record run, working on engines, routes, tests, and detailed plans. Six engines had been burned out, blown up, or worn out by their



Somewhere in Illinois! Roger Whiting looks disgruntled over a tire change. Below: The author poses somewhere in Nebraska, while his brother takes the picture.

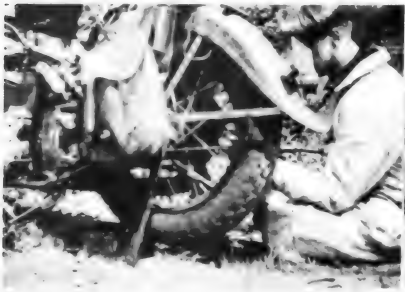
Shadow—and sunshine! The picture below shows brother Roger working on a flat, while the author, in white coveralls, looks very gay about the whole thing.

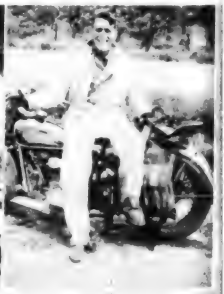
own vibration as we "suped them up." I had virtually designed a new engine for this trip. The flywheel had been lightened to get extra acceleration. Larger manifolding and carburetor added to the power. An improved dry pump oil system had been devised. The final test motor, with higher compression, larger valves, higher lift cams, and an extremely hot high-tension magneto, had been adopted by the manufacturers. Our record cycle was a "pilot" model, preceding regular production, but it was a stock job, right off the assembly line.

In practice spins we had chalked up 2,647 miles before we started the transcontinental run, at exactly one minute past midnight, May 27, 1935, and we knew we had a "hot" engine, capable of high cruising speeds. Our equipment was packed in the saddle bags, our night goggles snapped tight over our eyes, and to the accompaniment of family "goodbyes" and the official wave of William Heisermann of the American Motorcycle Association, we shoved off from the New York side of the Holland Tunnel. I twisted the throttle, the Y motor roared, and we raced through the white-tiled tunnel, dead in the center of the lane police had cleared for us six minutes before. Before we were halfway under the Hudson River the speedometer needle was flicking 85.

Flashing out of the tunnel exit into New Jersey we soon had to cut speed, for a police escort is not part of the equipment of amateur motorcyclists. We stuck pretty closely to traffic regulations in congested areas, but on the open stretches we had to make up time . . . and risk arrest.

Three times motorcycle police set out after





us before we'd gone a hundred miles. Each time I shouted back to Roger: "Wave goodbye to him!" And each time when I twisted my left hand in the motorcycle equivalent of "step on it," we roared away from our pursuer. Our only serious chaser was a big police emergency car, complete with searchlight, siren, and determination. We had to top eighty before our final goodbye to those boys.

We weren't being lawless . . . just in a hurry. After we crosed the Pennsylvania line we were congratulating ourselves on keeping an exceptional average despite numerous cities and town . . . and Bang! Our first blow-out, which we hadn't counted on at all, boomed under the rear seat at seventy miles an hour. I fought the machine down to a stop, and at three o'clock in the morning we fixed a pinched tube. Seven minutes after three we climbed aboard, this time with Roger driving, and headed forward. We drove for nearly twenty-four hours after that with hardly a stop, making some of the best time of the trip, although we had expected slower going.

We had gone nearly 900 miles when we stopped at Kentland, Indiana, south of Chicago, and fell asleep in a tourist cabin almost without undressing.

Early the next morning I was writing in the log book "Depart for Iowa."

The cycle was beginning to look dustier than we were, but the engine was still clicking beautifully, despite our excessive cruising speeds, when we really hit trouble in Iowa. With a scornful disregard for transcontinental cyclists, storms had hit the state, and road after road was flooded. The cycle's dust soon became mud, and for a time we thought our speed record was going to be mud too.

We hit more floods in Nebraska, until we were steering by the telephone poles alongside the inundated highway, with water washing our floorboards. It wasn't until we reached Salt Lake City that we were out of the flood area with its detours and delays. Then all we had to worry about were mountains, rain, snow . . . and cowboys. One cowboy, with the best of intentions, succeeded in herding a hundred head of cattle right across our road. We were able to decelerate to sixty, before we had to start weaving in and out. Once we grazed a cow, bouncing the cycle

Tired and disheveled, the brothers pose for the camera in Los Angeles, shortly after having crossed the finish line after their record-breaking run from New York.

halfway across the road, and I thought we'd have accidental steak for supper, but we roared on safely.

There wasn't really any page marked "Close Escapes" in our log book of the 8,500-mile trip to California and back, but if there had been we would have been able to put a subheading on it: "No spills." Yet there were times when a sudden personal contact with the road seemed inevitable. Once we zoomed over a small hill and headed straight for a "dip"—a stream running across the road. The warning sign was down and we hit a hundred-foot stretch of mud and water at a clip of nearly sixty miles an hour.

"Hold everything!" I yelled. Roger was holding onto the safety grip with both hands, which was about all he could do. As we skidded and slithered to a perilous stop we both had to keep our legs out to balance the cycle: the rushing water caught Roger's heavily booted feet and started to drag him off his seat. I turned to see him hanging on his safety belt just as the cycle stopped.

The Whiting brothers look mighty pleased about their achievement. Roger at the right, C. Randolph on the left.

"Lemme outta here," he was laughing. It really was funny.

Just as I turned and unsnapped the safety hook I felt the motorcycle skidding out from under me, down into two or three feet of slimy silt. We were both laughing so hard at our predicament that we staggered away without knowing where our mount was!

"A fine pilot you are," Roger was scoffing. "Now we'll have to take soundings to find the cycle!"

And that's what we had to do . . . probe for the cycle in the mud (it was getting dark by that time), pry it up with a long pole, and hilariously wheel it out of the "dip" to dry land.

There our real troubles began. We were muddy, but the cycle was invisible! We had to clean the chain, take off the carburetor horn, and transfer as much ooze as possible from cycle to cyclists. Finally the engine ran again, while I praised the waterproofing job done on the ignition system, and we splattered our way to the next town and a garage with air pressure for cleaning, hot water, and millions of paper towels.

"Next time," said Roger, "we're getting an amphibian tank!"

That tandem sleeping idea was to lead us into even more dangerous situations before we were through. Once, in broad daylight, I was dozing on the rear seat when I felt the cycle lurch. I was too tired to open my eyes even when the lurch was repeated. Then we began to bounce. I looked up sleepily, to stare straight ahead at a tree that seemingly was rushing at us at fifty miles an hour. Roger had gone to sleep at the handlebars . . . the penalty for too much forced driving.

There was no time to play alarm clock to the driver. I lurched to the left, forcing the cycle to turn, and as my brother woke up enough to resume steering we glanced off the tree and skidded to a stop—not a spill—a hundred yards out in a field. After that sleep-riding experiment there wasn't a yawn to spare for days!

The ceaseless grind of two hours driving, two hours resting on the tandem wore us down by fifteen pounds apiece. We had a total of five flats to break the monotony and eat up precious time, but even so, after we stopped for the second and last night in Cheyenne I checked the log at breakfast time to discover we had an average of 58 miles an hour to our credit—including all stops.

"If we pick up a little speed and run all night we'll break the record," I said to Roger. "What say?"

My partner's answer was to snap the saddle bags shut, adjust his goggles, and start the engine. I swung into the seat behind him, and we shoved off, set for an all-night run through Utah and Nevada.

It was just past noon the next day when we crossed into California on the last, hot run of our trip. I was singing figurative hymns of praise to the larger cooling fins on the cylinders and counting hours on my fingers to see what would happen to the record if all went well. We must have been losing track

[*Continued on page 124*]

She's Got A Good Grip On The World

THIS English girl refers the bewildered porter to her collapsible globe as she asks a few questions about her intended route. These geographical globes of the world are becoming extremely popular in Europe, and thousands have already been sold. Made of fabric and mounted on sticks, they can be shut up like umbrellas and taken along on trips without the slightest inconvenience.

Easy With That Dagger, Mr. Moto!

AN EXPERT Japanese swordsman tests one of the modernized versions of the heavy, two-handed swords with which the ancient Samurai killed their enemies. It was all part of a competition held recently in Tokyo, in which swords made by the best swordsmiths in the country were given special tests. The war in China has revived interest in old Japanese swords. Officers are equipped with a slightly modernized version of the ancient weapon.

Somewhere A Voice Is Calling

FIGURING that his own voice would irritate him less than anyone else's, Bill Richter, a Brown University sophomore, rigged up this radio-phonograph contraption which automatically plays a recording of his own voice at 7:30 a. m. The voice coaxes, gets firm, pleads, and finally bellows the command to "Get Up!" Although yawningly reluctant, Richter obeys himself, as the picture shows.

A mean mattress offers a challenge to Harmon Rumzie's technique, and above we see him accepting that challenge with a bit of fancy footwork. Note the look of determination on his face. Below: The lady illustrates how an "un-Harmonized" mattress can spoil one's beauty sleep.

Harmon Hits The High Spots!

THERE'S more to mattress-walking than stepping all over perfectly good upholstery. At least, so claims Harmon Rumzie, America's pioneer mattress-walker who has all the niceties of bed-stomping down to a science. Rumzie, who has been working with a manufacturer of custom-made mattresses for almost twenty-five years, is now stepping high towards fame, although he side-stepped failure rather narrowly in the early days of his career.

Mr. Rumzie's employer is one of America's foremost manufacturers of quality mattresses and explains that since most people sleep more on the center than on the sides of mattresses, the springs in the centers of his products are made to provide somewhat more resistance to safeguard against sagging, the bane of most mattresses. This makes the mattress a bit awkward at first, and necessitates breaking-in. For those who are too timid to do their own breaking-in, Mr. Rumzie is a breaker-inner par excellence. Not that he minds the clients who phone his employer

[*Continued on page* 127]

Come, come, Harmon, that's loafing on the job! Or maybe the job is completed, and like any first class artisan, Harmon believes in taking pride in his work

Look Down To See Over, Is His Method

IN 1939, crowds prevented Milton Feinberg, of Los Angeles, from getting a good view of the Pasadena Tournament of Roses. This past New Year's he was determined his view would be unobstructed, and the result was this open periscope of two mirrors placed at angles on metal poles.

That's The Old Headwork, Boys!

THE only artillery regiment in the world which carries its guns on the heads of the regiment's members is the Light Battery of the Nigeria Regiment, in Africa. The upper picture shows the gun crew with their piece assembled and ready for action. Below, the gun team is about to march off with the dismantled barrel.

"Perfect" Reflector Is Now A Reality

PERFECTLY colorless reflectors, lacking in the greenish or reddish tints found in most mirrors, are being made by a new process in which a "panchro" metal alloy is electrically deposited in perfectly even layers. The method is the same as that used to coat the new 200-inch telescope at Palomar Mountain, California. So smooth is the reflector that losses in reflection are virtually eliminated and precious light is saved in devices like airplane landing lights and flashbulb photography reflectors.

Here's A Porpoise With A Porpoise

PUTTING a porpoise in a corset is a strenuous job, as these Swarthmore University scientists discovered when they tried it. Hoping to gather some unknown facts about the animal (no, it isn't a fish!) the gentleman took readings of the porpoise's heartbeats with the corset-like contraption. Everybody seems pleased about it except Pedro, the porpoise.

The Atom Takes a Beating!

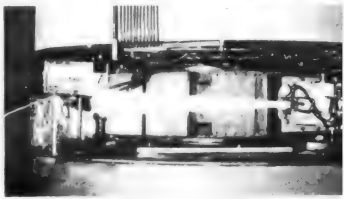
THE most powerful atom smasher ever conceived by the mind of man, that would dwarf present similar devices 10 or 15 times and whose huge electromagnet alone would weigh between 4,000,000 and 6,000,000 pounds, is the new project on which Prof. Ernest Orlando Lawrence, newest Nobel Prize winner in physics, is now hard at work.

This device is an enormous cyclotron that would create atomic particles 50 times as potent as those from radium and which would permit a frontal attack on a colossal scale against the nuclei of the atoms.

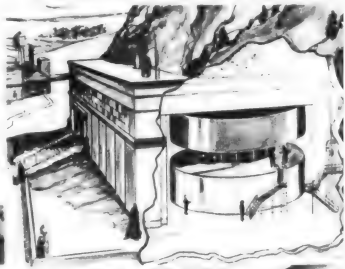
The penetration of the secrets of the mysterious cosmic rays by literally creating them, to some degree, in the laboratory, the possibility of the production of practical atomic power and the transmutation of the elements of the kind that ancient alchemists dreamed about; all these are among the potentialities of the enormous cyclotron which Prof. Lawrence now seeks to build.

The youthful University of California

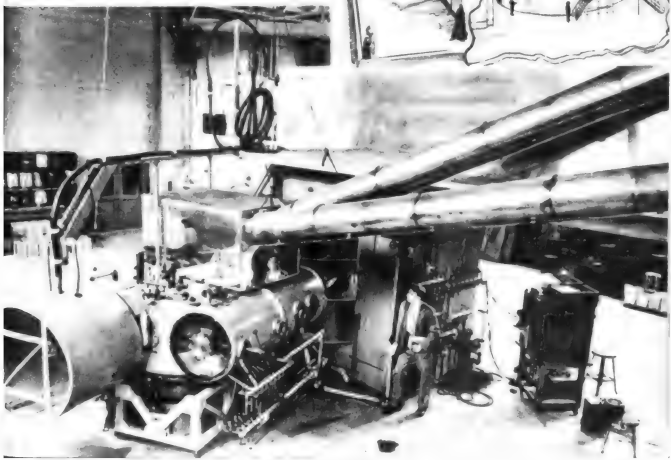
[*Continued on page 117*]



The most powerful beam of energy ever created by man, the 16,500,000 electron volt deuteron beam from the University of California cyclotron. Below: Artists conception of the hillside laboratory which would house the huge 5,000-ton cyclotron proposed by Professor Lawrence.



Below is the world's largest and newest cyclotron, the 200-ton giant of the University of California, showing the vacuum chambers down which the atomic particles are speeded, with energy as great as 32,000,000 electron volts, after they have been accelerated in great spirals in the cyclotron proper.



One end of the Build-It-Yourself workshop, in San Francisco, where doctors, lawyers, clerks, policemen, merchants, ministers and others spend their spare time building things they've always wanted to build.

THREE firemen heaved together and the heavy box was in its place on the hull of the motor cruiser.

"We got tired of sitting around the firehouse, passing our spare time playing pinochle," a lanky member of the trio volunteered, "so we started to build a boat. She's a shallow draft thirty-footer. Picked up the motor in an auto junk yard for twenty bucks. Whole boat won't run over two hundred. Going to use her for hunting and fishing trips.

"The box? Just a big icebox that'll hold plenty of fish and game—"

"And beer," the fat fireman added, grinning.

They are hammering and sawing away on the cruiser in the nation's first Build-It-Yourself workshop. It is a huge loft in downtown San Francisco that has been equipped with over $5,000 of the latest wood and metal working tools.

Around us scores of busy men in overalls are bent over carpenter's benches. They look like factory hands, but among them are doctors, dentists, lawyers, clerks, police, merchants, ministers—a first rate cross-section of San Francisco.

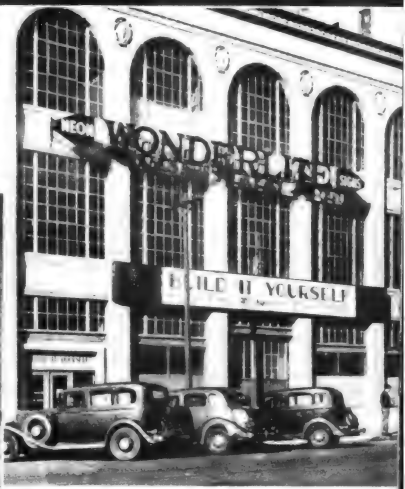
The idea is the brainchild of a public accountant and an air

Eddie Husted (left) and Neal Jacobs, two men behind the Build-It-Yourself shop at one of the racks of handtools.

Bites 'Frisco

by Jack Pollexfen

Millions of city-dwellers want to build things, but haven't the room nor the tools. Two San Franciscans thought about this situation and decided to remedy it—the result: the Build-It-Yourself shop!



Above is the outside of the workshop, which occupies the second floor of this left building. At the left is an electrical appliance salesman doing a bit of welding on the rolling cottage-salesroom which he is building in his spare time at the Build-It-Yourself shop.

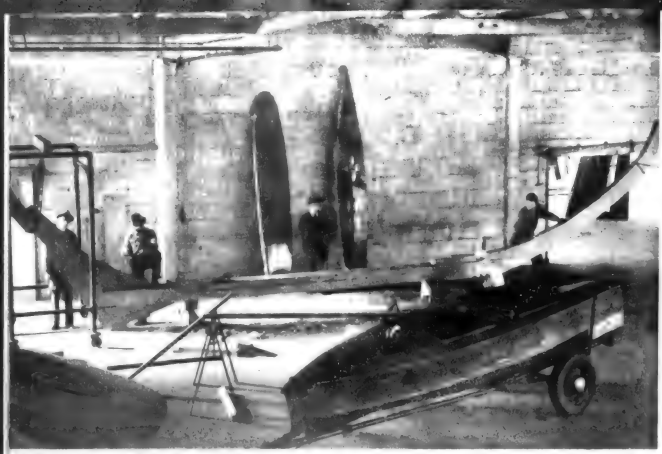
pilot, Neal Jacobs and Eddie Husted. Like a couple of million other Americans they had hammered away in basement and attic workshops since they were boys, but they always lacked the proper tools and working space. Checking notes, they decided that thousands of other amateur craftsmen must be in the same spot. The Build-It-Yourself shop is the result.

Small charges are made for the use of space, equipment, and a private locker. A first rate mechanical library, and files containing thousands of plans and blueprints of every conceivable kind of building project, can be used without charge. Other free services are drafting equipment and tables, and expert professional advice whenever a kink gets into a job.

Even at midnight the workshop is a beehive of activity. Schooners designed to sail around the world, schooners designed for bathtub cruising, a magnificent Louis XIV desk, rustic cabin furniture, an air glider, a streamline model train, a deluxe apartment on wheels—these are only a few of the jobs in various stages of planning or construction.

An elderly gentleman at the electric bandsaw was carefully carving out a rib for the thirty-six foot yawl he is building to cruise the South Seas.

"She'll take about two years to build," he proudly explained as he showed the plans,



We're not quite sure just what kind of a boat this is starting out to be, but we're reasonably positive it is neither a rowboat nor a canoe—whatever it is, it will probably give its builders plenty of fun while they're doing it!

The gentleman, above, is working on one of the shop's lathes, turning out a part for an invention which will make it possible to use an outboard motor inside a boat.

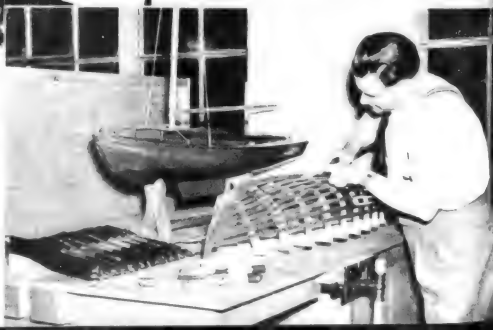
Right: Another Build-It-Yourself fan is working on a model ship, using a new plywood technique. Among the shop's assets are a good supply of excellent tools.

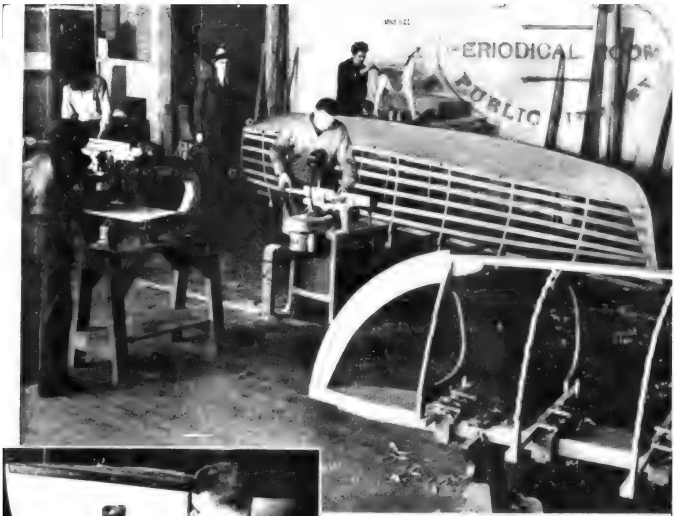
'because I can only work nights and weekends."

"But in 1941 when I go on pension she'll be ready to sail out the Golden Gate—bound for some of those islands Jack London wrote about.

"Have I been tied down to a desk all my life?" He chuckled at the question. "Not exactly. You see, I'm a railroad engineer—but I read pirate stories when I was a kid!"

Building a sea-going boat in the shop is not as hard a job as it might seem at first glance. The amateur boat builder is supplied with professional plans and he even cuts out parts of his boat from full size paper patterns—not





Boat building is the most popular project among the men who come to the workshop. In these two pictures, we see three different boats in various stages, of construction.

unlike the kind mother uses for a dress. An experienced ship's carpenter is on hand to see that nothing goes wrong. If the amateur is careful, and has a good stock of patience, there is no reason why he should not be able to turn out a boat that can compare favorably with many a professional job. Costs will run about one-third the market price of the boat.

Boat building is, by a comfortable margin, the most popular hobby. On the floor, in various stages of construction, are everything from ocean going schooners and yawls to outboards and kyacks.

One kyack is being built by a university senior who plans to cross the continent in the boat next summer. Starting at the Pacific he will paddle up to the headwaters of the Columbia river, hitch-hike with his little folding canvas boat a short distance to the beginning of the Missouri, drift down that river, make his way up the Mississippi and through the Great Lakes, then down the St. Lawrence to the Atlantic.

Next to him two high school boys are building a midget racing car out of junk parts. Scores of other jobs are scattered about the workshop.

That man humming a wedding march, very much off key, as he rubs down the stain on a table leg, is a motorcycle cop in working hours. For months he has been putting in all his spare hours at the shop with the idea of surprising the girl he is to marry shortly, with five complete rooms of handmade 18th Century furniture. His pieces are reproductions of museum specimens and the workmanship matches professional standards. For $250 and his time, the policeman will be able to present his bride with furniture that would run about $1,500 in one of the better stores.

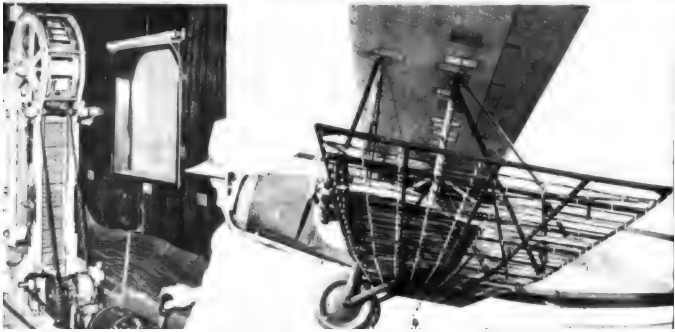
[*Continued on page 119*]

Some People Couldn't Stomach This!

WE CAN think of pleasanter ways to have our digestion upset, but then, everybody to his own opinion. Frank Richards, of California, is shown here absorbing the terrific shock of an 18-pound sledge-hammer. He has absorbed thousands of such blows in the stomach, kidney and heart during the past 19 years, and has yet to be floored!

Flying Sign Is World's Largest

THAT isn't a new type of airplane wing on the plane below—it's the largest flying electric sign in the world! Suspended underneath the lower wing of a huge tri-motored Boeing transport, the sign is 110 feet long and features moving letters twelve feet high, operated by the complicated contact machine below. Illumination is provided by 1,000 separate bulbs.



Bringing back memories of a bygone day, the old square-rigger, *Tusitala*, is still a majestic ocean-front sight

A Beauty Comes Back To Life!

AMERICAN seamen, thrown out of work by the Neutrality Act, have begun the work of restoring to seaworthiness the *Tusitala*, the only surviving American square-rigger.

The *Tusitala* was reclaimed from a scrap dealer's pier by the U. S. Maritime Commission. Reconditioned, it will be used as a training ship for cadets, in Miami, Florida.

The men working on the *Tusitala* are American sailors who have been "stranded" by the Neutrality Act. The ship is being restored to seaworthiness, after which it will be sailed to Miami, Florida, and used as a training ship for merchant marine cadets.

Little Men, You've had a Busy Day!

Music, maestro, please! The little four-piece orchestra prepares to mangle some Mozart, or battle some Bach, all with great seriousness. Below: Adoration personified is this little fellow as he pours out his soul to the pretty picture girl on the page of the magazine.

They may not be experts, but it's not because they aren't giving their all for winter sports. Like many humans, they may not be very expert on skis, but that doesn't keep them from trying their hardest.

MADE of steel and wood, with their parts connected by tiny screws, these funny little toy-men are made to amuse children and grown-ups, alike. They may be twisted into any desired position, and their strange poses seem to ridicule man in many ways.

Gone With The Wind

SHAPED like the dorsal fin of a shark, this curiously designed ice boat took part in the championship races of the Eastern Ice Yachting Association, held on New Jersey's North Shrewsbury River. That's the owner, J. L. Finch, of Patchogue, New York, peering out of the tiny cabin.

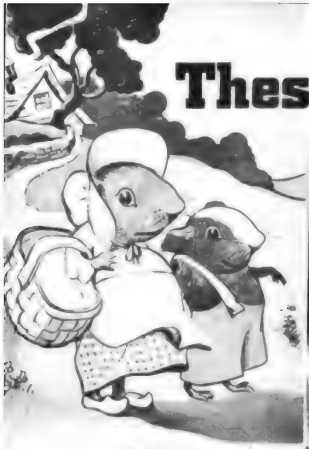
Match It If You Can!

MATCH companies are said to be negotiating with Joseph Landers, a 20-year-old Albany, N. Y., youth, shown with the formula he developed that makes it possible to light a match after it has been in water. Landers has been told that his formula may possibly revolutionize the match industry.

Here's A Machine You Can't Fool

TO REDUCE auto accidents and to spot motorists with defective vision, applicants for driver's licenses in Iowa and Kansas must now pass a stiff eye examination. By means of a projector and special slides, applicants are tested for literacy, visual acuity, astigmatism, color blindness, and malingering. The slides were developed, in part, to trap applicants with defective vision who were smart enough to memorize the old-fashioned test charts.

These Little Pigs



William Eurich weighs one of his guinea pigs before sending it off to market and finds it tips the scales at 2½ pounds. This little fellow may help in man's war against disease.

Life was a pretty glum affair for William Eurich until that happy day when he decided to take a crack at raising guinea pigs. Today, sitting on top of the world, Mr. Eurich can thank his lucky stars—and guinea pigs!

by

Joseph Lawren

AN ARMY sergeant, thinking it would be fun to put the new buck private through a burlesque examination, asked the awkward recruit what he'd do if he saw a battleship steaming majestically across the parade grounds. The recruit appeared stumped for a moment, then smiled triumphantly.

"Well, I know one thing," he said. "I'd swear off drinking!"

Undoubtedly the recruit knew his battleships. The sergeant really might have stumped him, however, if he asked this question:

"What would you say if you saw a live guinea pig, made up within an inch of its life in lipstick, face powder, eye shadow, mascara, eyebrow pencil and rouge?"

Perhaps the answer would have been the same, but it needn't have been. Guinea pigs have worn makeup for some time now, and, because of this fact, pretty ladies throughout the country have felt free to daub on all sorts of paint and goo, secure in the knowledge that the stuff wouldn't hurt their delicate ectoderms so long as it didn't injure those of the pigs.

For, paving the path to beauty is one of a guinea pig's foremost chores. The men of science recommended this course of action after they had discovered that the piggies—in the matter of bloodstreams, skin pigmen-

Went To Market!

Eurich in front of his chuckwagon and delivery truck, part of the thriving business he has built up with guinea pigs. Right: A closeup of the wireless hutches which Eurich invented for the cavies.

tation and physical and nervous reactions—approximated most closely the functions of the human body. Furthermore, the guinea pig is the most tractable and docile of all animals.

That is why, before milady plows into the beauty potions, the latter are first tested on a neatly shaved cavie, as the English prefer to call a guinea pig. And that is why doctors, scientists, specialists and chemists, in hospitals and laboratories everywhere, were putting up an unearthly howl not long ago for healthy guinea pigs—20,000,000 of them—for use in medical research. And that is why William C. Eurich, of St. Petersburg, Fla., scowled at his faltering insurance business, a year or so ago, and turned to raising cavies.

Today Mr. Eurich is a blueprint of prosperity.

The success of this Ziegfeld of the animal kingdom was not, however, a matter of pure luck. True, Mr. Eurich knew about as much about bringing up guinea pigs as the writer does about how to build a cello. But he was hopelessly in debt, his home was snugly covered with a most non-decorative mortgage, his wife and daughter were practicing ways to starve gracefully, and there was about as much prospect of getting another job as there was of growing young again. So Mr. Eurich turned to cavies.

A graduate of Germany's Heidelberg, Breeder Eurich attacked the guinea pig

Left: One side of the pigsty with the hutches stacked six high. Note the protective bar which keeps the pigs in. They can travel from one hutch to the next at cleaning time, without being handled. Below: Three stages in the life of a guinea pig—shortly after birth, midway, and in full maturity, ready for their trip to market.

problem from a scientific angle. He discovered that most guinea pigs up until that time had been raised as pets, and medical men were clamoring for animals of an entirely different nature. They wanted them in a clean, healthy and satisfactory state, and the breeders from whom they'd been buying them up until then were just unable to make supply equal demand.

Accordingly Eurich purchased five cavies, installed them in a hutch in his backyard and, as he watched them grow, he scoured through all the books he could find on the "hows" and "don'ts" of guinea pig breeding. He studied the animals' habits, their food, their breeding, their health—and their possible methods of sale—and he took nothing for granted. He checked every word of the printed page against what actually was transpiring in his Florida backyard—and, after five months, he was convinced that what the ads had said was true, there was big money to be made in guinea pigs.

So, borrowing $300 on his furniture—the only unpapered security he had left—Eurich went into business. That was just about a year ago. Today, his debts have been paid, the mortgages have been burned with all due ceremony, he is father to a brood of some 500 cavies, he owns two delivery trucks and an expansive array of hutches next door to his home, and his bank account is running into extra figures.

Very nice, what? But, there's something behind it.

Eurich discovered in his reading that there was an increasing demand for guinea pigs in medical circles; yet the breeding of the pigs was not keeping pace with this demand, and was, in fact, still groveling in the atmosphere of 1917, when a learned hand sat down and wrote that "the guinea pig is typically a pet . . . and has no other excuse for existence. . . ." Naturally, with such a stigma over their heads, cavie raisers hardly could be blamed for being unable to turn out more than 2,000,000 pigs a year—or approximately 10% of the demand!

But that wasn't all. Despite the fact that the post-World War years saw this increasing

demand for more and more cavies for medical work, as well as animals for use in cosmetics laboratories, food experiment stations and health stations, Eurich discovered that there was a host of misinformation on the lowly guinea pig.

He discovered, for example, that sawdust—universally used and recommended as the best bedding for guinea pigs—actually did them great harm, for the pigs ate the sawdust and came down most regularly with intestinal disorders. Eurich put the little fellows to bed on shavings. Next, he found that the wire coops in which the majority of pigs were then being kept failed to permit ample ventilation, and furthermore necessitated the breeders' handling the pigs when he cleaned the coops. This was bad, for it seems that, above all else, a guinea pig most abhors being pawed. Accordingly, Mr. Eurich made hutches without wiring, having learned that the animals were not rovers and would stay at home, so long as there was a protective board to reassure them.

These wireless hutches, it turns out, are most revolutionary, and are discussed in no book on the subject. Yet, they work very well, the pigs traipsing from one hutch to the next when cleaning time arrives and back to their own when someone gives the signal.

Another discovery of Mr. Eurich's was that the guinea pig, being a nervous creature—and almost human—acquired nervous indigestion if he had to fight for his food in the communal troughs then being used by all pig breeders. It seems that each pig tore into his trencherwork in a great fear that, if he didn't munch fast, he'd starve—or, at best, get the leavings. So Mr. Eurich fixed up

[*Continued on page 120*]

The open food pan. The two pigs in the foreground seem to think that kissing comes before eating. Note that shavings and twigs are on the hutch floors, rather than sawdust, which Eurich discovered made the pigs sick.

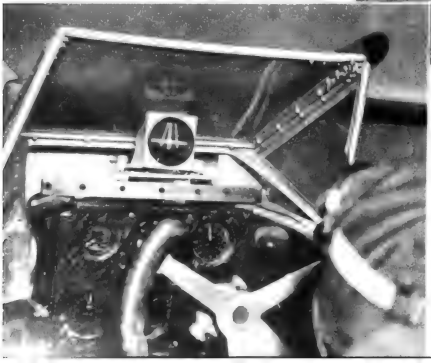
Below: A motherless baby being fed milk. It is only for a day or two, as it will take to adult rations very shortly after birth. Below, right: Eurich's individual feeding trough gives the pigs calm security as they eat.

Camera Lens Speed Doubled

DR. C. HAWLEY CARTWRIGHT, of Massachusetts Institute of Technology, is about to cover camera lens parts with a vacuum glass chamber under which the lenses are treated with the new process he invented to double the speed of the lens. The treatment is done in a high vacuum and consists of evaporating metallic fluorides which condense on the glass surface.

"Athlete's Foot" Defeated!

RECENTLY developed by a Yale University scientist, this new instrument is called a "rheoderm," and gives prompt relief for stubborn fungus infections such as "Athlete's Foot," which formerly required prolonged treatment.



Navy Develops New Blind Landing System

A NEW blind landing system, employing a 3,000-foot length of cable buried underneath the airport runway has recently been developed by the U. S. Navy. A current cycle fed through the cable sets up a magnetic field which is picked up by an indicator needle in the plane.

Pictures, Planes, and Persistence

Below is Reginald Denny, who turned his hobby into a paying business. He is shown inspecting a Bleriot model, an exact duplicate of the plane that first flew the English channel. At the right are some of Denny's model planes.

Below: The interior of Denny's workshop. The mask worn by the workman keeps balsa dust out of the lungs.

WHILE all the world is lead to believe by overly anxious press agents who make their living extolling the virtues of movie stars, that each of their charges is an expert in some line other than motion pictures, Reginald Denny, whose pictures are now few and far between, is one of the few who has ridden his hobby so far that it makes him a few bucks now and then. In fact, he is the only one who has turned his hobby into a corporation backed up by a manufacturing plant and all that goes with a first class industry.

To the average outsider who has never visited Denny in his shop, all would appear to be beer and skittles. This is not so. Denny has made his shop pay the hard way. To get a true picture of all of this, we must go back a few years when Denny was enjoying some idle time between pictures. It seems that the kid next door had one of the first of the gas-driven model planes and was out on the front lawn trying to get it to take off. Denny heard the commotion and lent the lad a hand in starting it with the result that the plane was completely demolished. In trying to get it fixed Denny made the acquaintance of several model airplane men and one of them convinced him that he ought to take it up as a

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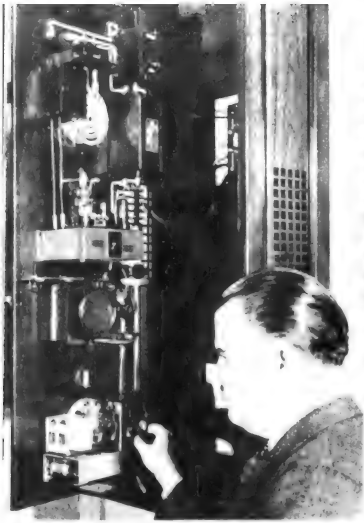


Ring Out, Wild Bells!

USED by the Edison Company, of New York City, the radio operated device at the left lights up a neon tube and rings chimes when it detects a storm within a radius of 100 miles. As the storm comes nearer, the chimes get louder and the neon tube burns brighter. Company operators, in the room above, telephone outposts to determine the exact position of the storm as soon as it has been called to their attention by the Storm Detector.

Blessings From A Bomb

YES, there *are* bombs like that! One of them in shown here, a radium bomb, recently installed in the Los Angeles Tumor Institute. Shown in use at the left, the bomb contains 4 grams of radium worth $100,000. Three capsules of the precious radium are shown above.

TOMORROW'S ROCKET SHIP?

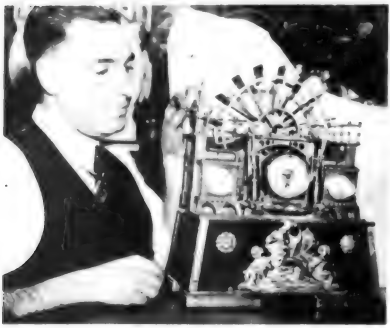
ARTISTS' conception of a large passenger rocket as suggested by recent developments in the rocket field and by recent patents issued covering the storing of fuel and improved control methods.

The rocket ship shown is made in two sections—the aft, streamlined section being articulated so that the blast may be directed

[*Continued on page 125*]

Time Clicks with

Fred Jensen gives his great-grandson a few pointers on the fine art of watchmaking and repairing, as they inspect some of the unusual timepieces. Below: Fred Jensen III inspects a "side-wheeler."

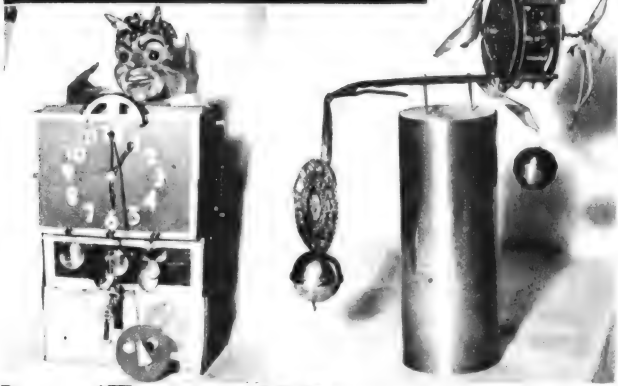


IF YOU were to enter a small, wedge-shaped shop on New York's lower waterfront and ask for Fred Jensen, your answer would be a question—"Which one?"

For this tiny shop is the working place of four generations of expert watchmakers, and from great-grandfather Jensen down to great-grandson Jensen each bears the first name of "Fred." Since 1885, the Jensens have not only kept pace with Father Time in their watchmaking pursuits, but have often left the old gentleman a bit behind, and probably more than a little bewildered.

The Jensens are as much interested in their hobby museum of curious timepieces as they are in actual business. Fred Jensen, Sr., a spry and cheerful looking

Tricky Ticks



At the upper left is a "Devil clock." As the six pendulums swing, the devil's hands move until he thumbs his nose; meanwhile, the little man at the bottom performs all sorts of gymnastics. Directly above, a carefully balanced clock is suspended on two metal phonograph needles—rocking to and fro, it acts as its own pendulum!

Fred Jensen, Jr. (second generation), inspects the "Helicopter clock" which he and his father designed. Both of them were interested in aviation, and this model beats its wings upon the hour.

man of 73, started the hobby a few years after the firm opened. He has made an intensive study of clock-making history and is as much at home with facts and figures about clocks and watches as he is with cogs and springs—and that's saying plenty!

The tiny shop is a mecca for those who own unusual timekeepers. Some have been brought in to be repaired because they are family heirlooms, others have been brought in to be sold, or even given away as junk.

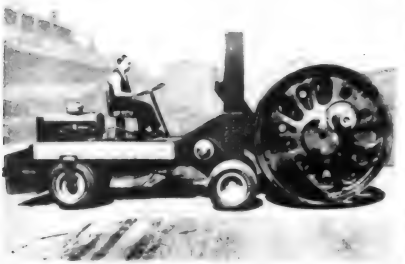
[*Continued on page 123*]

Hair Raising, That's What It Is!

THIS girl's hair is actually "standing on end," and small wonder—she's having an electric charge of half a million volts sent into her body! The static electricity generated for this spectacular experiment was harmless, however, and was part of a display of electrical wonders recently exhibited in New York City. As the electricity accumulated in her body, the volunteer found her hair standing rigidly erect.

Plant A Seed And Have A Garage

OF COURSE you'd have a bit of a wait on your hands—one or two thousand years, but then maybe you're the patient type that wouldn't mind. The man in this picture was lucky, because this huge redwood stump was right next to his house. Approximately 1,500 years old, the tree was ravaged by lightning 50 years ago, and the stump presented a problem, finally solved by converting it into a spacious garage.

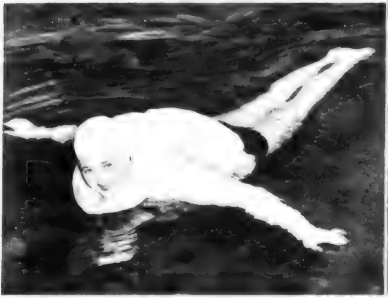


Big Wheels For Such A Little Car

THE explanation is that they don't really belong to it. They are big locomotive driving wheels being moved from one part of a Chicago railroad yard to another, and the job is being done handily by this newly-devised industrial "Jitterbug" truck. The huge drive wheels of the locomotive are seven feet in diameter, and weigh over 21,000 pounds, but the little truck takes them in stride.

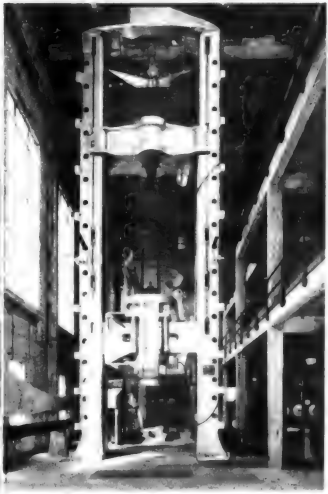
No Sir, We Can't Let Her Drown

COMBINING fashion and safety as a result of the war, this new type of life jacket for ship wear is far less cumbersome than previous life belts and jackets, and will keep the wearer afloat in the water for three weeks.



A Swell Nutcracker!

CRUSHING down with the strength of fifty locomotives, the world's largest testing machine crunches a huge concrete block (below) like sponge cake. Located in the engineering laboratory of the University of California, the giant tester develops a force of 4,000,000 pounds.



Fish Have Sense of Smell!

Nic Sprank Offers $5.00 For Best Oddity

Five dollars will be paid for the oddity used by Nic Sprank as his central illustration. One dollar will be paid for all others used on this page. Send your oddity to Nic Sprank, care of Mechanix Illustrated, 1501 Broadway, New York, N. Y. Source or proof of each oddity must be given. Send all oddities separately, not with other manuscripts or letters.

You're RIGHT—That's WRONG!

Here are 25 statements, some of them true, the others false. The trick is to separate the *true* statements from the *false* ones—and it isn't as easy as it looks! Use a pen or pencil and check the correct box under each statement and see how you make out! After you've given yourself the test, try it out on friends and other members of the family and compare scores. They'll enjoy it and so will you.

Are you ready? Let's go!

1. Radio listeners usually hear a radio program before the people in the rear of the studio audience.
   True ☒ False ☐

2. California has the longest coastline of any state in the United States.
   True ☐ False ☒

3. Because they fire much larger guns, sailors in the U. S. Navy are not required to master the use of rifles and pistols.
   True ☐ False ☐

4. A limnologist is a person who makes a study of lakes.
   True ☐ False ☐

5. The openings found between joined rails of a railroad track are due to poor workmanship on the part of the track-layers.
   True ☒ False ☐

6. A binnacle is the box which houses the compass on a ship.
   True ☐ False ☐

7. The center of a hurricane is an area of almost perfect calm.
   True ☐ False ☐

8. Observation balloons were used in the American Civil War.
   True ☒ False ☐

9. A United States patent is issued for a term of 17 years.
   True ☐ False ☐

10. When under way at night, a ship has a green light on the port side and a red light on the starboard side.
    True ☐ False ☐

11. By established records, the altitude record of an airplane is greater than the altitude record for a balloon.
    True ☐ False ☒

12. A spider is not an insect.
    True ☐ False ☐

13. When porcupines are attacked by other animals or humans, they will shoot forth their quills like darts to protect themselves.
    True ☐ False ☐

14. The Mannerheim Line is the longest railroad in Russia.
    True ☒ False ☐

15. Los Angeles ranks fourth among the cities of the United States in population.
    True ☒ False ☐

16. The tail of an airplane leaves the ground first on a take-off.
    True ☒ False ☐

17. If you like rattlesnake meat, you may buy it in cans at many grocery stores throughout the country.
    True ☒ False ☐

18. The path of a projectile's flight is known as its itinerary.
    True ☐ False ☐

19. Standard gauge railroad track is exactly five-feet wide.
    True ☐ False ☐

20. The horn of a rhinoceros is composed of hair, grown tightly together.
    True ☒ False ☐

21. Dynamite can be burned without having it exploding.
    True ☐ False ☐

22. The helicopter is an astronomical instrument used for the purpose of studying the sun.
    True ☐ False ☐

23. No member of the U. S. Army or Navy Air Corps is permitted to go aloft without a parachute.
    True ☐ False ☐

24. A "Q-boat" is a tramp steamer or fishing boat fitted with hidden guns used as a lure for submarines.
    True ☐ False ☐

25. A scalene triangle is one in which all the sides are unequal.
    True ☐ False ☐

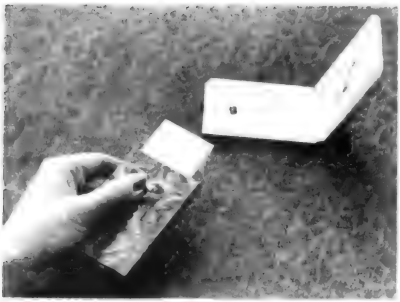
WHAT'S YOUR SCORE?

To get your score, simply give yourself 4 points for every question you answer correctly and total the result. If your mark is above 90, you are exceptional; if it is between 80 and 90, you deserve high praise; if it's between 70 and 80, you're good; between 60 and 70, fair; and below 60—well, try again next month!

Answers will be found on page 122.

Combat Trainers For "Fighting Pilots"

DESIGNED specifically for the training of "fighting pilots," the new two-place Curtiss Falcon 22 advanced combat trainer, shown here, is the first of a large number recently completed for a foreign government. It is smaller than the well-known Curtiss Hawk, and incorporates the latest aerodynamic and structural advances. It is well adapted to all types of training activities.



No More Fumbling With Card Flip-Out

DURING his eight years in the electrical appliance business, Martin Weber of Alhambra, California, was continually enraged because he could find no satisfactory way to carry his business cards. It irritated him so much that he sat down with a tin pill box, a piece of clock spring and a rubber roller and came up with the tricky case shown here, so successful it is now manufactured on a large scale.

"Suicide" Rate Cut With This Reflector

VIRGINIA PECK, of Schenectady, New York, is holding a new stepped aluminum reflector, designed to keep high wattage street lamps from "committing suicide" by burning themselves up with self-reflected heat and light rays. The 48 small steps reflect the rays back so they just miss the filaments at the focus. Tests show that with a 500-watt bulb, the temperature at the focus is 275 degrees less with this reflector than with the old types

Training To Be An Ostrich?

NO, IT isn't a zombie with the measles, but a pretty girl (we suppose) hiding behind the newest thing in beach wear, at Miami. It's a freckle mask, with built-in dark glasses and a breather pipe to keep the wearer from smothering while she protects her skin.

New Device Will Aid Flying

LEWIS L. IMM, inventor and designer, and formerly an inspector of the Bureau of Air Commerce, is shown with his latest device, called a "Librascope," which will enable engineers, merely by twisting a series of geared dials, to find the maximum flight efficiency of any given plane under varying weather conditions.

A Soldier's Life Is A Harsh One

"AT EASE" and "On duty," are one and the same thing to this British Tommy, whose job is to search the skies for German aircraft. With a swivel chair that is practically a bed, including a special arm rest, his main problem would seem to be to keep from dropping off into a pleasant slumber. Maybe that's why there isn't any footstool for him to put his feet on!

Your Job! AVIATION

Top: Only the best of the airline-trained pilots are picked to handle these huge transport planes. You need twin-engine experience and at least 1,200 hours. Even then you go to school (see above).—American Airline photos.

by Donald G. Cooley

IF YOU'RE going to be an airplane pilot, you start young or you don't start at all. It's a lot like being a prizefighter: if you haven't started to learn your trade by the time you're 25 or 26, you're too old.

Are there any hard-boiled and convincing reasons why the mid-twenties should represent the age limit for embarking on a career as a pilot? Plenty of them! The young man has speedier physical reactions. He is more easily trainable. He has the time to invest in building up sufficient flying hours to qualify as an airline pilot. By the time he becomes an airline pilot he's going to be a lot older in years and in experience, with a minimum of 1,200 flying hours before he's even eligible. At 150 miles an hour, that's equivalent to seven times around the globe!

It is an expensive, arduous, exacting but infinitely fascinating trail you'll follow in be-

MECHANIX ILLUSTRATED aptitude tests will help you determine what type of job you are best suited for. The vocational analysis in this issue is on AVIATION, the fourth in the "Your Job" series. The current article tells what it takes to become an airline pilot. Next month Mr. Cooley will tell what you must do and know to become an aviation mechanic.

Above: The experienced pilot as well as the novice gets a test in the Link Trainer which stays on the ground but simulates every maneuver of a plane in the air. If you come out of this all right your flying ability is rated okay. Left: Once you have made the grade, you win a seat in the cockpit of an airliner. It's no place for a man who easily becomes confused when something goes wrong.—American Airline photos.

coming a flyer. More than almost any other occupation, with the possible exception of medicine, you should be *sure* you want to be a flyer before you go ahead. The aptitude test on page 71, plus the survey of pilot's jobs presented in this article, will give you a good idea of what you're up against and how well you're qualified. No test can give the lessons of actual experience, and there are always exceptions to any rule, but unless you run up a spanking good score in scoring your aptitudes, beware of downdrafts ahead!

"That aptitude test is too tough!" complained one earnest young man who came up with a low score. "It will discourage a lot of fellows from learning to fly."

It won't do that, for at least two reasons: the born flyer simply won't be discouraged; and hundreds of men who might not make the grade as commercial pilots will find other aviation jobs open to them if they have rolled up a few flying hours. It is worth repeating that we are discussing piloting as a money-making career.

The test *is* tough, but that's because the field is tough. You not only have to satisfy an employer that you know your stuff, but you have to prove your ability to government inspectors before you can even look for a job.

Latest figures show 26,144 pilots holding government certificates. Of these, about 1,500 are air-line pilots or co-pilots. A large proportion of the rest hold private licenses; they can't be counted—yet—as career men. In between are commercial and limited commercial certificate holders, pilots who do most of the money-flying outside of the regularly scheduled passenger routes.

There are five times as many doctors as there are pilots of all classifications, four times as many auto mechanics, four times as many radio service men. Offhand, it would seem,

from those figures, that competition would be slight. But aviation is not large as industries go. A single large mail order concern does ten times as much dollar business in a year as all the country's air lines combined. Is it any wonder that aviation executives can afford to be choosy about their employees?

Now that those hard facts are disposed of, it's time to emphasize that a pilot's career is worth every ounce of blood-sweat in attaining it. A pilot is constantly dealing with hard facts, making up his mind, going ahead. That's one of the qualifications.

Let's take another look at you. Do you haunt the airports near your home, watching the big ships come in, feeling your blood tingle at the proximity of those streamlined sky beauties and the men who fly them? Have you struck up acquaintances with men around the field? Do you speak the airman's language? Do you read everything you can lay your hands on about aviation? Have you ever built a model airplane—even a tiny one from a simple kit?

Above: The experienced airline pilot not only knows how to handle his plane, radio and navigation, but he knows something about the engine, too. Below: These passengers' lives are in the pilot's hands.

These are indices of your interest. They are activities well within the range of anyone. If you haven't engaged in some of them, the only honest conclusion must be that your interest in flying is not very intense. But interest is only one signpost. You need some very positive qualifications too.

Here is a picture of an airline pilot—see how well you fit it:

You are seated at the controls of a four-motored transport plane of the new type which just this year is becoming standard on the big airlines. You have had to learn the peculiarities of the big new ship. You know that within the year top airplane speeds have been pushed up 100 miles an hour, that the war has given research a tremendous impetus, that instruments are getting more complex, that soon you'll have to learn about stratosphere flying—but you love it all because the urge to keep on learning is part of the very warp and woof of you.

In front of you, above you and below you are banks of instruments, nearly 200 of them. You not only watch them—you know instantly what to do if anything goes wrong. You are a competent radio operator, with phones clamped to your ears. You know what weather lies ahead of you and are able to make observations of your own because you have made a study of meteorology. It

Test Your Qualifications for the Vocation of AIRPLANE PILOT

Take plenty of time in answering these questions; be as scrupulously honest in your answers as you can, remembering that airplane pilots must satisfy rigid requirements of the government as well as of employers. Check "yes" or "no" in the proper column. Score 4 for each question. A total of at least 76 qualifies you for a private license; 88 for an air-line pilot's license.

	YES	NO
Have you ever built or flown model airplanes, or joined a glider or flying club?		
Do you visit airports frequently, seeing ships at close range?		
Have you actually taken a plane ride so you're sure the idea of flying satisfies but does not alarm you?		
Are you under 26 years of age?		
Have you completed at least two years of high school?		
Do you stand with the top quarter of your classes scholastically?		
Do you rank high in mathematics (all branches through trigonometry) as well as in physics and science?		
Are you a regular reader of aviation journals and science magazines?		
Have you definite mechanical ability, expressed in such ways as keeping a car in repair, model-making, house repairs, home workshop projects?		
Do you drive a car and is your record entirely free from accidents for which you were even partly to blame?		
Can you qualify for Army, Navy, or C.A.A. flying training as explained in this article; if not, can you get enough money to take a good flying school course?		
Are you willing to invest several years of your time with slight financial return?		
Are you steady, dependable, poised, painstaking, invariably finishing anything you start?		
Can you act lightning quick and with good judgment in emergencies—never get nervous, jittery, or lose your head?		
Do you respond well to discipline, without damage to self-respect?		
Would you like a job which requires you always to keep studying and learning, adjusting to new conditions?		
Do you have steady nerves and excellent coordination (perhaps exemplified by competence in such activities as tennis, auto driving, marksmanship, boxing)?		
Can you handle a sailboat expertly, demonstrating knowledge of wind currents?		
Do you have enough confidence to buck a tough game that has employment standards as rigid as any industry in the world?		
Do you honestly believe that piloting is only one part glamour to nine parts monotony, routine, hard work, knowledge, tedious attention to detail?		
Are your personality qualities such as to win confidence and respect—your dress and appearance good, your conversation intelligent?		
If you do not live where aviation opportunities exist, are you able to go where they do?		
Have you talked with any airplane pilots about their work?		
Are you accustomed to making your own decisions, accepting full responsibility—never any buck-passing?		
Do you understand what is meant by aileron, rudder, tachometer, air speed, flipper, slipstream, wind sock, angle of incidence?		
Above all, is your health practically perfect (can you hear a whisper 8 feet away, see keenly without glasses, have no physical, nervous, or psychological handicaps?		

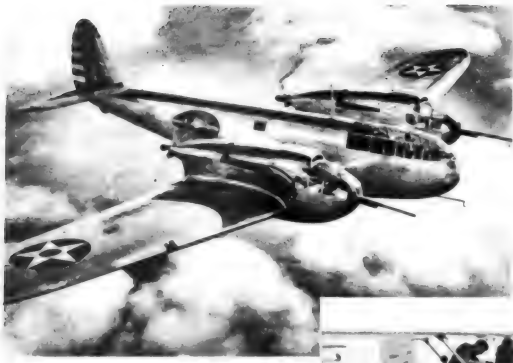
is easy for you to plot a course with a slide rule, for you have mastered mathematics through trigonometry.

You are in fine physical condition because every three months you have to pass the rigid tests of a flight surgeon who won't renew your license if you fail to get a tooth filled when he tells you to. Behind you is a minimum requirement of two years of high school training. Actually, you are a college graduate because your employer practically insists upon it. You have had engineering training and that gave you an edge over other applicants when you were seeking your job.

The government, requiring 1,200 hours of solo flying, 100 hours of it at night, and 20 hours of blind flying by instrument, is far more lenient than your company. You put in at least a year's service as co-pilot before you were made captain of your own ship. Your actual hours of flying time range between 3,000 and 5,000. With an airplane worth $100,000 and the lives of a score of passengers regularly in your hands, you may be sure that your superiors have satisfied themselves that you are cool-headed in an emergency.

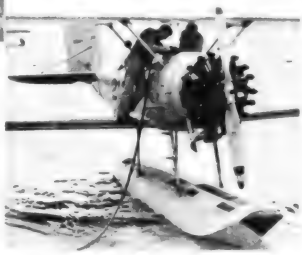
[*Turn to next page, please*]

Right: There's still room for the experienced pilot in aviation. As proof, see this advertisement which appeared recently.



Left: The best of America's flying material is picked for the Army—and Navy, where you learn to fly bullet-like pursuits and monster bombers. Many army-trained pilots become airline pilots.—Official Photograph, U. S. Army Air Corp.

Below: The Navy is as tough on pilots as the Army. When you get through this course, you really know how to fly. Some engine training is part of the course. The photo shows a student on a Navy trainer.—Official Photograph, U. S. Navy.



Your income is rarely less than $600 a month, often $800, and may even reach $1,000, depending on the amount of flying done. You very likely belong to a pilot's union with nation-wide affiliations, which functions principally to bargain collectively over wages and hours, since eligibility for the job is regulated by the government.

There you are, an airline pilot, tops in your profession—and you wouldn't trade jobs with any other man on earth.

Can you see yourself fitting into that picture, meeting the requirements listed? Before you become captain of your own ship you will have worked for your company as a co-pilot, possibly for several years. As a co-pilot you will have to satisfy practically the same requirements as a pilot. You will handle the controls, check the engines and instruments, operate the radio, navigate. Your income will range around $190 a month to begin with, advancing to about $250 where it is likely to remain for some time until, and if, you make good and are promoted to captain.

There are several ways—all of which will shortly be explained—of meeting the qualifications for an airline pilot's license. One of the most common is to acquire a commercial license and build up flying time while being paid for it.

The commercial pilot operates sightseeing ships, chartered planes, does skywriting, crop dusting, aerial photography, fire patrol—a vast amount of flying which does not include carrying passengers on regularly scheduled lines. License requirements are less rigid. You must be at least 18 years of age, able to read, write, and understand English, vision normal or capable of being so corrected, no physical conditions which would interfere with safe operation of an airplane, and at least 200 hours of solo time including 10 hours of cross-country flying. A limited commercial license is similar but requires only 60 hours of solo flight. Both types call for spot landings and maneuvers to satisfy inspectors of your competency.

Your income as a commercial pilot will be hard to predict. Many men make good money, some approaching the income of airline pilots. There are more men with commercial licenses, however, than there are jobs to go around. Some of the most competent men branch off into various aviation jobs where piloting ability is an asset although duties are principally on the ground. Sales-

manship is one such job. More money can often be made by commissions on sale of planes and equipment than by sticking to straight flying. In time, a commercial pilot who sticks to the field can roll up the 1,200-hours which make him eligible for airline pilot's tests. But it's a long grind and many fall by the wayside or are lured by better money in related fields.

There remain other pilot ratings which can only be regarded as preliminary to a professional career. A student pilot must be at least 16 years old, able to understand English, physically sound; glasses may be worn to correct eye defects. After 8 hours of dual flight he is eligible for solo pilot's rating, which requires familiarity with air traffic rules and demonstration of ability to take off, land, turn, etc. After 35 hours of solo flight, study of weather, maps, instruments, demonstration of ability to make spot landings, figure eight turns, spin recovery, side slips, etc., you are ready for a private pilot's license which will permit you to fly for your own amusement.

For further details on requirements, write to the Civil Aeronautics Authority at Washington, D. C. Brief though the above summary is, it no doubt sounds as if we were "throwing the book" at you. Well, you might as well realize that flying isn't all glamour—book learning has a lot to do with your career as a pilot. If the aptitude test looks so much like a tedious study assignment to you that you don't feel like putting in the effort to take it, you are lacking in one of the qualities that goes into the makeup of a top-flight pilot—a trigonometry textbook doesn't rate high for reading interest, but your born pilot digs into it with willing application.

"How are you?" is the first question that will be put to you when you decide to become a pilot, and it's no casual inquiry. Some of the world's finest work has been achieved by men who were physically handicapped or suffered chronic ill health—Darwin, Steinmetz, Roosevelt, Stevenson—but as a professional flyer you simply have to keep in superb physical condition.

Eye tests are particularly exacting. Correction with glasses is permitted in qualifying for licenses, if such glasses bring visual keenness to normal, but depth perception, muscular balance and other optical conditions must be normal. Army and Navy fliers cannot

[*Continued on page 128*]

Above: Class-room instruction deals with problem of flight. Model planes are used to illustrate the theory. Below: Thousands of future commercial pilots start on light planes to build up the required flying time.

The U. S. Quarantine boarding vessel, "B. W. Brown" is now in use as a marine ambulance.

The Doctor Goes

Recently inaugurated in Miami, the new "Doctor - to - Sea" service insures the sick or injured seaman a bedside call, with an ocean ambulance to bring him ashore if necessary.

by

John L. Coontz

Left: The radio operator in Miami sends the message telling the ship that a doctor is being sent out immediately.

THE big oil tanker rolled and pitched in the choppy water off the south Florida coast. Captain Kellgard cast an anxious eye to the southeast, scowling at the rising gusts of wind.

"Behind schedule," he muttered, shaking his head. "And my engineer has a badly crushed hand." Suddenly an idea came to him, and he left the bridge hurriedly. A minute later he was at the door of the radio room.

"Operator," he said. "Get a wireless to Miami Quarantine and tell them we have an injured man aboard and we're coming into port for treatment."

At the Public Health Quarantine Station in Miami, Dr. Donahoo, the chief medical officer, sat at his desk, an important desk, one destined to save many lives, and a great deal of valuable time and money. His four assistants busied themselves with office routine, hopefully awaiting the call that was to give the first try-out to the new "Doctor-to-Sea" service.

Out of a dozen points under consideration, Miami had been chosen for this experiment

Down To The Sea

The "Brown" approaches the tanker. Below: Lowering the injured man to the ambulance ship.

because of its proximity to the greatest sea traffic lane of the Americas. Between six and eight thousand ships pass Miami each year, bound for world-wide ports—American ships to European and African ports, European ships to Gulf ports, Central and South America, Havana, and the Panama Canal.

An emergency illness aboard ship is a serious thing, particularly since freighters rarely carry a ship doctor. The new service, inaugurated at Miami, insures the sick or injured individual a bedside call at sea, and a sea ambulance to bring him ashore if his condition warrants it.

Dr. Donahoo did not have long to wait. The station's radio operator grabbed a message blank and began to jot down the message he was getting through his earphones:

> "American tanker 'Vistula' engineer badly crushed hand in machinery. Bringing him in to Miami for hospitalization.
>
> (Signed) Kellgard."

No sooner was the message laid on Dr.

Left: Dr. Aaron Cristensen makes an examination of the injured engineer aboard the oil tanker. Below: The injured man is transferred from the "Brown" to an ambulance which is waiting.

Donahoo's desk than he swung into action with his new service.

"Wireless the 'Vistula' captain that he need not come in," he instructed his wireless operator. "Tell him that a staff doctor will meet his vessel at the Miami Sea Buoy at 5 a. m., Wednesday, and to please advise us of any change."

He then called Dr. Aaron Cristensen of the staff in for consultation, glancing at the barometer above his desk. "Steadily falling," he observed.

"You had better take the 'B. W. Brown'," Dr. Donahoo advised, as the two men parted. "You may hit a storm."

The "BWB," the "big boy" of the Service, was built for hurricane weather, with its twin Diesel engines, speed of twelve knots and cruising range of 300 miles. The other three remaining boats in the Service, a gas boat of cruiser type, a cockpit boat with Diesel engine and a small open gas boat for ferry purposes are used in milder weather.

At the appointed hour the 60-foot "BWB," its medicine cabinet stocked with emergency medical and surgical supplies, Dr. Cristensen, a pilot, engineer and deckhand on board, struck out for its sea rendezvous.

Churning through the choppy waters it was not long before the big tanker, its grey sides aflame with a huge American flag painted there as a war precaution, loomed up near the Buoy. On the deck was gathered the crew, eager to lend what aid they could to their disabled comrade. It did not take the "BWB" long to come alongside the sleek "oiler." Captain Kellgard of the tanker gave orders for taking Dr. Cristensen aboard, and soon the Public Health physician was at the bedside of his patient.

Dr. Cristensen found the engineer with a hand too badly crushed to permit extensive bedside treatment aboard and ordered him ashore, instructing Captain Kellgard to send a wireless to Quarantine to have an ambulance meet the "BWB" when she came in. The injured man was carefully let overboard by block and tackle, made comfortable in one of the six "BWB" bunks, all hands assisting in the job of transfer.

So was written the first chapter of the new "Doctor-to-Sea" service in the annals of the Public Health Service.

The new service had, in addition to giving the wounded man the speediest and best attention, saved Captain Kellgard and the owners of the oil tanker "Vistula" between $200 and $300, the sum involved in pilot fees, dock fees, quarantine and inspection fees, loss of time, and the trouble and delay in making cargo port on schedule.

[*Continued on page* 123]

Paper Hanger's Nightmare

OVER 200,000 postage stamps ornament the walls of Father Alexander Bucci's house in Burbank, California. Unlike most collectors, who prize stamps for their rarity and value, Father Bucci collects them for the decorative value of the intricate mosaics he makes with them.

A Flat Would Mean Work!

WHICH is one of the reasons, perhaps, that this huge, doughnut-like tire for airplanes is bullet-proof. Made for giant English army bombers by a secret process, these tires are of such a nature that machine-gun and rifle bullets make little impression on them. Such tires will prevent landing crack-ups due to bullet-punctured landing gear.

The Lady Or The Tiger?

WE'LL always pick the lady, but this new exercising machine promises us a combination of both. Based on the principle of the "tiger stretch," the machine requires extensive stretching, and is said to induce suppleness without hardening the muscles.

Extension Tubes for

Left: Camera with double extension tubes attached. Objective is to decrease working distance between lens and object. A 1½- and 3½-inch tube combination places lens 9 inches from object. Above: Notice metal collars on extension tubes.

by Ormal I. Sprungman

HOW would you like to take a close-up of a portion of a flea's tongue or a centipede's ear?

Perhaps that's stretching things a bit, but an extension tube on your camera will work wonders in permitting you to shoot life-size studies of flowers, bugs and other midgets heretofore impossible to film even with portrait attachment lenses.

The size and length of each tube will depend a lot on the type of camera and the lens itself, which of course must be removable. The tube really acts as a double extension bellows, and because of the shallow field, it is most advantageously used on reflex cameras or those having ground-glass focusing panels.

Cardboard tubes may be used if dull coated inside, but these are not nearly as satisfactory or substantial as metal tubes of different lengths, threaded and collared to take lens and lens board. This permits using tubes of varying length either alone or in combination with others. If you do not have facilities for metal working, a local machine shop can handle the work for you.

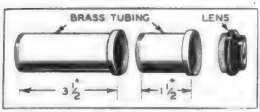
I made two "bellows" of $\frac{1}{8}$-in. brass tubing, 1½ and 3½ inches long, respectively. Threaded at both ends, the two tubes could be used together to give a 5-inch extension. One end of each tube has a collar on it.

The inside tube diameter will depend on the lens size. In this case, the tube diameter

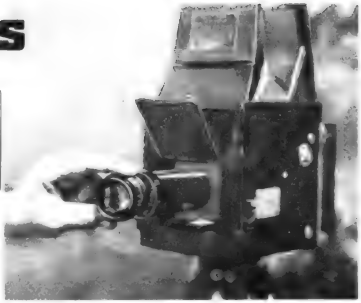
Left: Close-up of a magazine cover taken with standard lens at closest working distance of 22½ inches. Distance calibrated for 3¼x4¼ camera.

Right: With the 1½-inch extension tube, the camera can be focused within 14 inches of the book cover to produce this size magnification.

Close-Ups



Above: Sketch shows simple coupling arrangement of extension tubes. Right: Lens is unscrewed from its standard lens board, mounted on collared end of the extension tube and entire tube screwed back into the lens board.



was approximately 1⅝ inches. Smaller lenses may take smaller diameters, but it is well to remember that extension tubes that are too long may crop the corners of the final picture, thus reducing negative size by producing a circle on the film. Since such reduction can be seen on the ground glass, there is no danger of accidentally eliminating an important part of the scene.

With the 1½-inch tube, for instance, the 3¼x4¼ picture size is reduced to 2⅞x4¼. The 3½-inch tube further cuts the size to 2¾x4¼, while the two tubes in combination reduce the image to 2⅝x4¼.

The magnification power of such a set of extension tubes is miraculous indeed when scaled. With the 3¼x4¼ Graflex and a 5½-inch lens, the closest working distance is 22½ inches. This includes a field 13¼ inches wide. Extension tubes change this as follows:

Length of tube:	Closest working distance:	Width of field:
1½-inch	14 inches	6½ inches
3½-inch	10½ inches	4⅛ inches
5 inches (combined)	9 inches	3⅛ inches

The usefulness of such tubes is obvious, for they provide a low cost means of increasing the range of ordinary cameras.

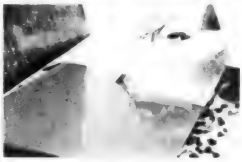
With other types of cameras, which do not have ground glass focusing, a scale must be developed for proper working distances for each tube in order to insure pin-sharp focus under every condition. A square of roughened celluloid, tracing linen or ground glass may be held over the opened back of the camera to aid in focusing while preparing the scale. Naturally, it is impossible to check focus on non-reflect type cameras with film in place.

Left: With the 3½-inch lens extension tube, the camera can be brought within 10½ inches of the subject to produce this enlargement.

Right: A 5-inch extension composed of both the 1½- and 3½-inch tubes places lens 9 inches from subject, reducing field to 3⅛ inches.

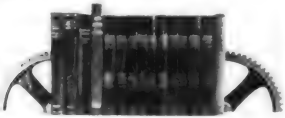
How to Build SECTION

Farm Trailer. Plans for building a simple, inexpensive trailer for farm use are on page 92. Uses scrap and junked parts.



Ferro Tins From Sheet Metal. Make your own tins for ferrotyping glossy paper and save money. Page 109.

Gear Book Ends. Unique idea for the mechanical library. See page 105.



Featured Model for this month is the *Electra*, 35" gas powered luxury cruiser. Complete plans and instructions start on page 82.

PICK YOUR PROJECT

Illustrated on this page are some of the things you can build from the plans and instructions given in this section. Select the one or ones that appeal to you, turn to page indicated.

Water-level Control System for shallow wells keeps them from being pumped dry. Page 90.

Woodpecker Door Knocker. Novel and attractive gadget for announcing visitors. Turn to page 91.

TWO YACHT WHEELS

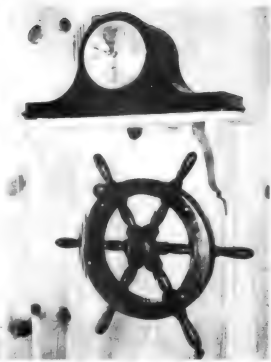
by Hi Sibley

ONE of these handsome yacht wheels is for marine use; the other makes an attractive wall decoration. Both are well designed and require only a lathe and scroll saw for their construction.

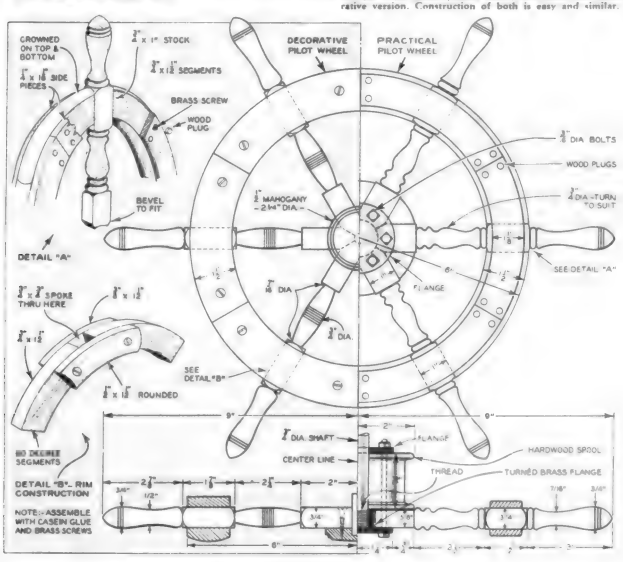
Mahogany Pilot Wheel For Wall

The left half of the drawing below shows the decorative wheel, which will lend an attractive boaty atmosphere to a room, especially if the marine motif is carried out in lamps, ash

[*Continued on page 135*]



At left is the actual yacht's wheel, and above the decorative version. Construction of both is easy and similar.



Build The [illegible]

by Nick Limber

Trim, buoyant and well balanced, *Electra's* stepped bottom enables her to show a good turn of speed, though she was not designed as a racing boat.

FOR many years naval architects have faithfully adhered to orthodox power boat design even though startling results were being achieved in other fields where industrial designers introduced radical changes. The apparent lack of modernization in boat designing has long been a source of annoyance to the streamline stylist.

Recently, however, several well-known designers, including the late "Tony" Fokker, invaded the boat designing industry and produced the first of the super-streamlined luxury cruisers. Their creations are indeed excellent examples of modern design engineering and may set the pace naval architects will follow.

Likewise, the model designing field is undergoing drastic changes and many super-streamlined models are to be anticipated.

Among the first of the new "super-super" modern boats, is the *Electra*. Designed primarily on a modernist formula the craft is an outstanding example of ultra-efficient performance and beauty. Clean lines, smooth curves, sturdy construction and fine detail are distinctive features of the sleek seaworthy cruiser, and model boat lovers will find her a splendid project.

The model is powered with a standard model air-

Motor installation is shown at right. It is not necessary to remove the cabin top when running the boat, as the cylinder is cooled through the forward "windshields."

Fast 35-In. Model Luxury Cruiser

plane gasoline engine of about ⅓ horsepower. Adhering closely to marine design formulas noted for efficient performance, the hull has been designed to deliver full efficiency at normal operating speeds. This however has been accomplished without the sacrifice of beauty, hence the builder is assured an attractive well performing craft if the instructions herein are carefully followed.

Before attempting the construction of the craft, study diligently the accompanying diagrams and illustrations. Read the instructions several times, referring to the drawings and carefully noting the use to which the various items included in the bill of materials are put. After this has been done, secure the following materials, clear your workbench and start construction of your *Electra*.

LIST OF MATERIALS AND THEIR USES

A piece of board of about 38 to 40 inches long by 12 inches wide and about ½-inch thickness is required as a building board.

A secondary board at least 14 inches in length by 12 inches in width and ½-inch thickness is nailed to the rear portion of the building board.

6 strips of ¼-in. square by 40-in. pine strips for cross-braces sheer, and chine.

1 strip of ¼-in. by ½-in. by 36-in. pine for sheer aft of cabin.

1 piece of ¼-in. by ½-in. by 36-in. pine for keel.

6 sheets of ⅛-in. by 8-in. mahogany or base for cabin, and hull covering.

4 square feet of ¼-in. three-plywood for bulkheads.

15 strips of ⅛-in. by ⅞-in. by 18 in. pine for deck planking.

7 strips of ½-in. by ⅞-in. by 18-in. pine for floor boards.

1 plank of balsa, medium hardness, ½-in. by 6-in. by 20-in. for cabin roofing.

2 blocks of balsa, medium hardness, 4-in. by 4-in. by 3½-in. for bow.

1 block of balsa, medium hardness, 6-in. by 1½-in. square for model dinghy.

2 blocks of ¼-in. by 2-in. by 3-in. pine for motor bed.

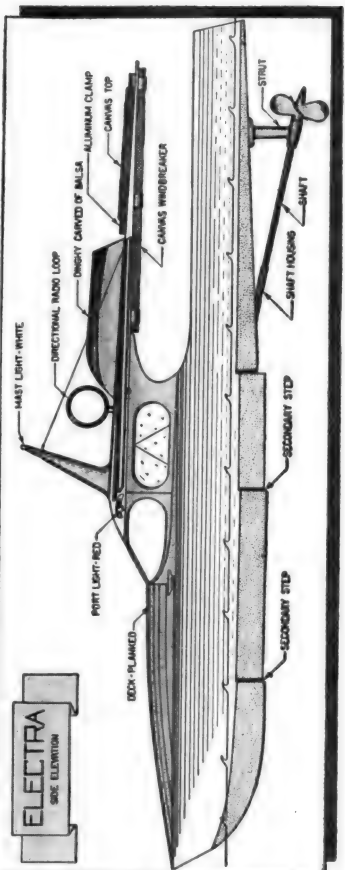
1 box, 1 inch No. 20 brads.

1 pint of casein glue.

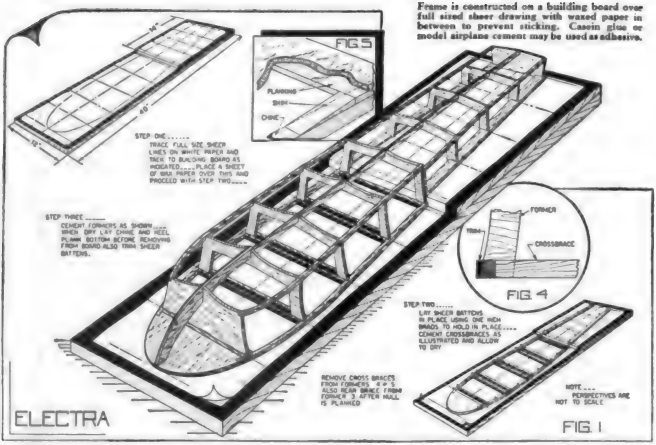
Sandpaper, paint, varnish, mahogany stain, and celluloid.

Nail the secondary building board to the main board as indicated in Fig. 1 and lay out stations and sheer line. Placing a piece of wax paper over the board, lay down the sheer frame of ¼-in. square pine, holding it into shape with 1-in. brads and cross-braces.

Trace the bow-plate former onto the three-ply, cut out with a small jig saw and lay into place as indicated on Fig. 2.

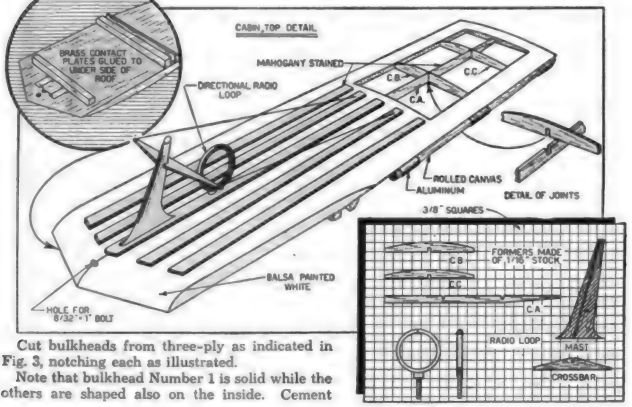


General outside details given above show completeness of realistic equipment. The cabin roof is instantly removable for easy access to engine and running lights are operated through small brass contacts. Side windows have celluloid panes and curtains, but forward ones are left open so that the air stream may reach the engine.



Apply a liberal amount of casein glue between the sheer and the bow-plate former. One inch brads may be used to strengthen joint.

formers 1 to 5 in their respective locations between the pine cross-braces, allowing the structure sufficient time for the glue to harden. Also cement bulkhead 6 to bulkhead 5 as



Cut bulkheads from three-ply as indicated in Fig. 3, notching each as illustrated.

Note that bulkhead Number 1 is solid while the others are shaped also on the inside. Cement

indicated in the diagrams. The aft sheer is now placed into position on the secondary or raised portion of the building board and bulkheads 7, 8, 9, and transom 10, are placed into position. The keel pieces are attached to the bulkheads as are the chines, the latter being single strips while the former is constructed of two strips. The stem plate is fabricated of three-ply and attached to the framework as illustrated.

The hull may now be planked. Smooth planking is used on the bottom portion aft of the main step. Two pieces of the mahogany or bass sheet are used for this purpose. Plank before removing frame from the building board.

The bottom portion forward of the main step is planked in a manner similar to shingling. This results in the formation of two additional steps of a secondary nature, nevertheless important to the efficient operation of the boat. Thus, the forward portion requires 6 pieces of sheet in all. It is important to note that the planking of the hull bottom begins at bulkhead Number 1, the double curve of the bow making it impossible to use anything other than a solid block forward of this former.

While the forward portion of the keel is cut so as to accommodate the secondary steps, the sheet used to plank the section must be shimmed up at the chine battens. Shims are made of ¼-in. strips of the same thickness as the covering planks. The planking may be held to the formers with straight pins driven partly into the assembly while the cement is hardening. After sufficient time has been allowed for the glue to harden, remove the pins and fill in the holes with plastic wood. Sandpaper smoothly and proceed to bevel the sheer battens so as to coincide with the curve of the former sides.

The sides of the hull are planked with the same material as is used for the bottom. These are planked in three sections as the curvature of the hull will not permit otherwise. The first plank extends from former Number 1 to former Number 4. A second plank is used to cover the section between Formers 4 and 5 while the third extends from 5 to the transom.

The procedure followed for the planking of the bottom is used in covering the sides. It might, however, be found necessary to moisten the covering on the outer surface in order that the bend be easier to achieve. Do not force the covering in any way. If the bulkheads are shaped as indicated in the

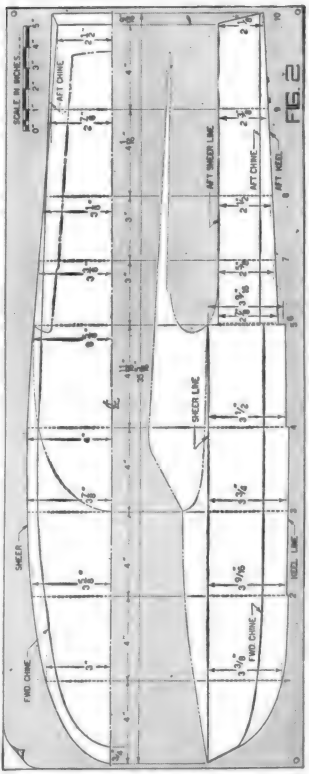


FIG. 2

Reproduce the lines full size before starting actual building, and check the accuracy of your model against them as you proceed.

drawings the covering will easily assume the shape of the hull. Sandpaper the unit thoroughly, and removing the brads from the outer side of the sheer line, lift the hull off the building block.

Cement the balsa block into place at the bow of the hull and when the cement has

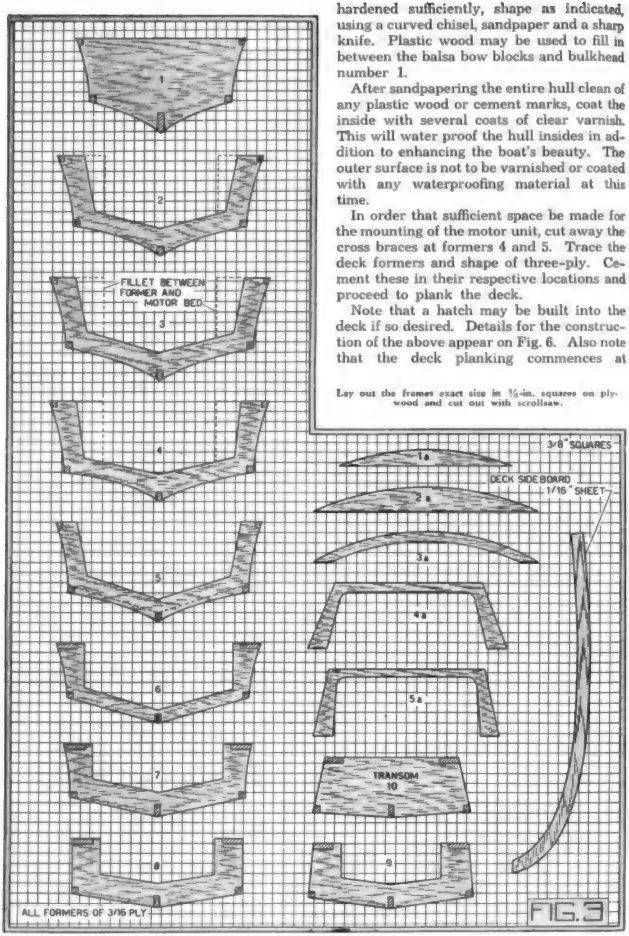
hardened sufficiently, shape as indicated, using a curved chisel, sandpaper and a sharp knife. Plastic wood may be used to fill in between the balsa bow blocks and bulkhead number 1.

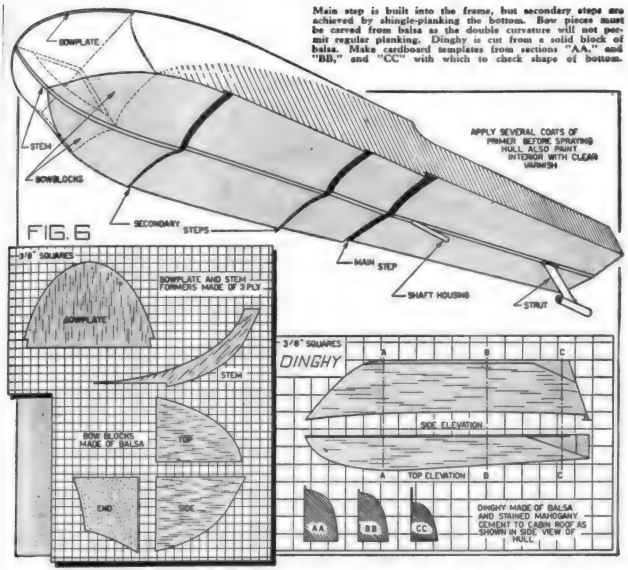
After sandpapering the entire hull clean of any plastic wood or cement marks, coat the inside with several coats of clear varnish. This will water proof the hull insides in addition to enhancing the boat's beauty. The outer surface is not to be varnished or coated with any waterproofing material at this time.

In order that sufficient space be made for the mounting of the motor unit, cut away the cross braces at formers 4 and 5. Trace the deck formers and shape of three-ply. Cement these in their respective locations and proceed to plank the deck.

Note that a hatch may be built into the deck if so desired. Details for the construction of the above appear on Fig. 6. Also note that the deck planking commences at

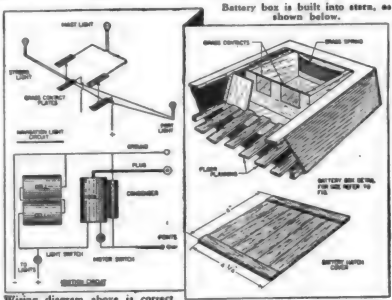
Lay out the frames exact size in ½-in. squares on plywood and cut out with scrollsaw.





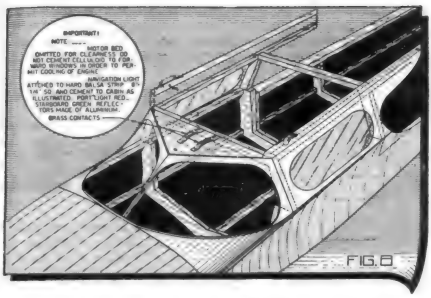
former 3. The portion of the deck to which the cabin is attached is of sheet veneer similar to the material used for covering the sides and bottom of the hull. The pine planks used for the deck are to be notched in order to accommodate the deck side boards. For the correct shape of the side boards refer to Fig. 7. These are also fabricated of the same material as used to cover the hull.

Again referring to the diagrams, shape the frames upon which the cabin is constructed. Cement these into place and carve of $\frac{1}{16}$-in. sheet mahogany or bass, the cabin sides and front. It will be advisable that the inner surface of these sections be coated with a liberal amount of airplane cement in order that they be fashioned without splitting. It is also advisable to moisten them



Wiring diagram above is correct for most motors.

Inboard profile and deck framing plan. Flywheel, propeller, shafting and strut may be purchased at any model supply store, and the former two should be of specifications recommended by your engine manufacturer.



Cabin framing plan shown in perspective with motor omitted for clarity. Note brass contacts for lights. Bulbs may be secured in five and ten or model supply store.

before cementing to the framework. Prior to this, however, complete the construction of the cabin frame as illustrated in Fig. 9.

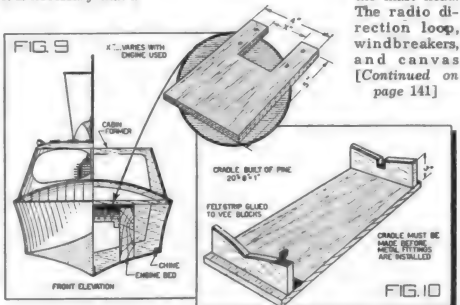
Referring to Fig. 10, construct the motor bed and attach to the hull. A liberal amount of glue should be used in this operation and when hardened, filleted with plastic wood.

Before attempting to install the motor or any of the metal fittings, it is necessary that a stand be constructed upon which the hull may rest while these installations are being made. Later, the stand may be stained and permanently used to display the model. Fig. 11 clearly indicates the construction of this unit.

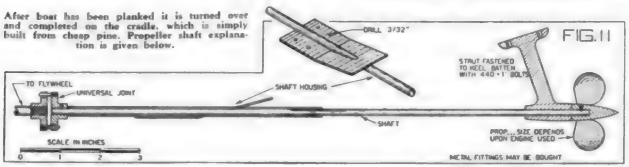
The metal fittings may be purchased at any model supply dealer and will depend upon the motor being used in each individual case. Little else can be said regarding these, other than to caution the modeler to be certain they are held fast into place. After the motor units are installed, the floor boards may be laid. These extend from bulkhead number 5 to bulkhead number 9. A battery hatch is constructed in the after part of the hull utilizing the space between the transom and bulkhead number 9.

Our attention is now focused for a second time to the cabin. The cabin top is constructed of medium hard balsa planking and to this pine strips, similar to the deck plankings, are cemented. The mast is fashioned of laminated bass or mahogany sheets. Provisions are made as indicated in the sketch, for the installation of a running light at the mast head. The radio direction loop, windbreakers, and canvas

[*Continued on page 141*]



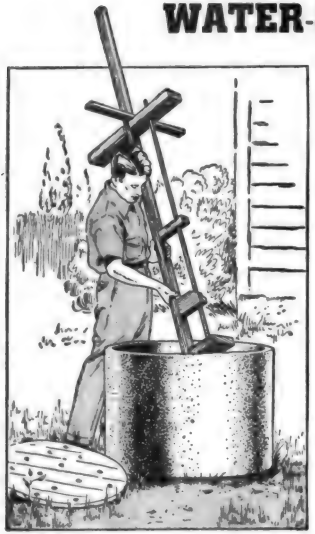
After boat has been planked it is turned over and completed on the cradle, which is simply built from cheap pine. Propeller shaft explanation is given below.



WATER-LEVEL CONTROL For Shallow Wells

Prevent your well from being pumped empty by installing one of these single-wire water-level control systems.

by J. Modroch



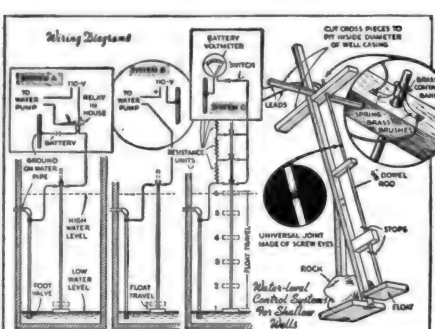
The wooden frame supporting float and switch mechanism is weighted and rests on the well's bottom.

SYSTEMS A and B in the diagram below will automatically shut off the water pump when the water in the well drops to a dangerously low level. System C enables you to take water-level readings from a meter conveniently located in a laundry, bath room, darkroom, or kitchen. Combining C with either A or B provides both automatic pump shut-off and water-level meter. And by substituting a multipole relay for the single-pole relay shown in A, auxiliary circuits can be made to operate signal lamps and warning bells.

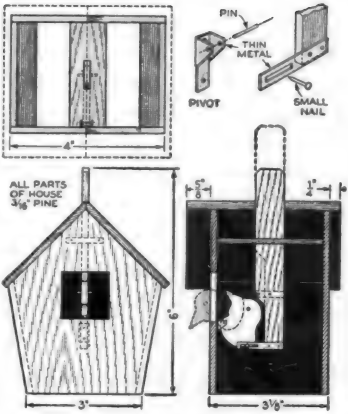
The float and switch mechanism is supported on a wooden frame that rests on the well bottom. If it is not convenient to anchor the frame by any other means it can be weighted down with a rock. The rise and fall of the float actuates the switch through the vertical movement of a length of ⅝-in. dowel rod. Since the switch, in order to be kept dry, must be located above the high water-level, the depth of the water at this level will determine the length of rod required.

The frame need not extend to the top of the well. It can be lowered with a hook or length of rope. Accordingly, the leads from the switch should be left long enough to permit the frame being lifted out of the well for the purpose of making adjustments and inspections. It will be noted that systems A and B re-

[Cont. on page 143]



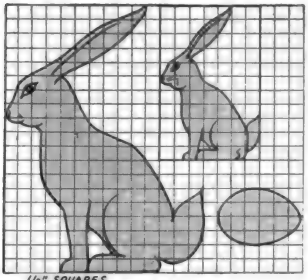
Birdhouse Action Toy

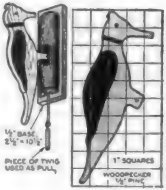


WHEN this birdhouse is picked up by the handle the bird pokes his head out through the hole to see who is disturbing him. When the house is set down he pulls his head back in again. This is an attractive and amusing toy in bright colors—the sides green, roof red, bird and handle yellow. All wooden parts are $\frac{3}{8}$-in. thick pine or whitewood, nailed together. A pin set into the handle serves as a stop. Note that there are only two moving parts.—*D. W. Clark.*

Woodpecker Door-Knocker

WHAT an ideal door knocker, especially for the rustic cabin or back door! Pull the chain and the woodpecker taps an announcement that there is a caller. A little time and elbow grease, plus a few inexpensive materials, are all that is necessary to make one.

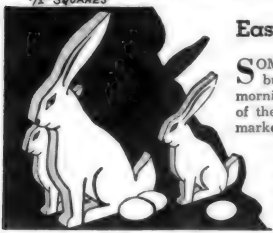




For the base select pine, ½x-2½x10½-in. Take a piece of undressed hickory, 8-in. long, 2 in. in diameter, and split in half lengthwise. In the center chisel an incision 2x¾-in. clear through the piece. Make a groove from the incision to the bottom of the hickory for a chain or cord. Cut woodpecker out of ½-in. pine with a jig saw. Put feet

[*Continued on page 142*]

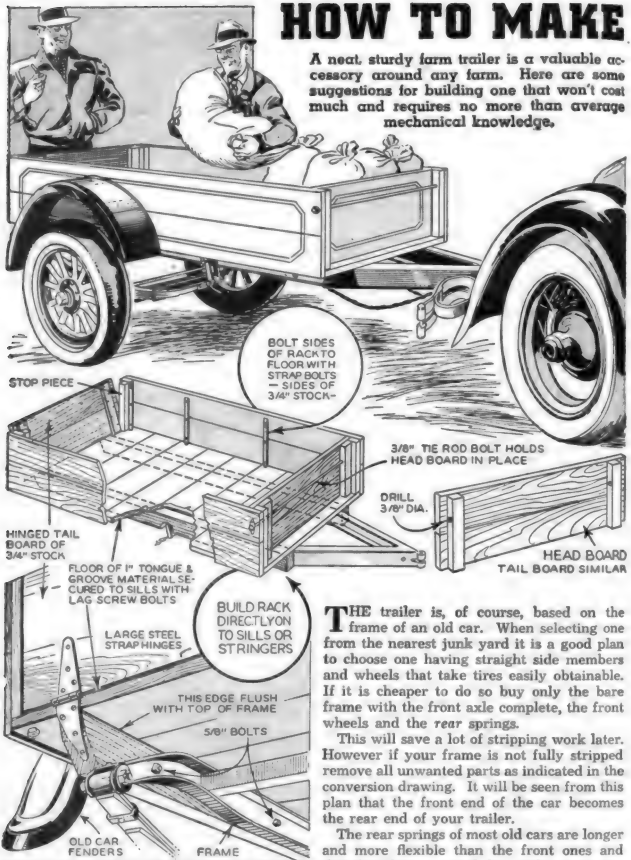
Easter Bunny Set



SOME child will be delighted to find this group of bunnies and colored eggs beside his plate on Easter morning. The diagram of ½-in. squares shows the outline of the large rabbit and bunny, the larger outline being marked off in squares and outlined on pine stock from 1¼ to 1¾-in. thick, and the bunny outline on ¾-in. stock. Use the drawing for a guide, tracing the outlines, and then cutting out the figures on the jig saw and finishing with your knife. The eggs are lathe-turned, and about 3-in. long by 2-in. wide. Finish in bright colors.—*E. Van Horn.*

HOW TO MAKE

A neat, sturdy farm trailer is a valuable accessory around any farm. Here are some suggestions for building one that won't cost much and requires no more than average mechanical knowledge.



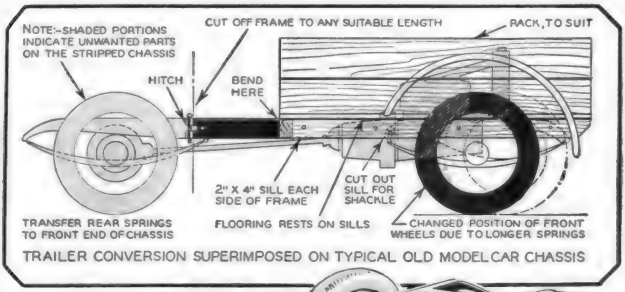
DETAIL OF CHASSIS AND RACK SHOWING METHOD OF MOUNTING SILLS ON FRAME
NOTE: FIT SILLS BEFORE CONSTRUCTING RACK

THE trailer is, of course, based on the frame of an old car. When selecting one from the nearest junk yard it is a good plan to choose one having straight side members and wheels that take tires easily obtainable. If it is cheaper to do so buy only the bare frame with the front axle complete, the front wheels and the *rear* springs.

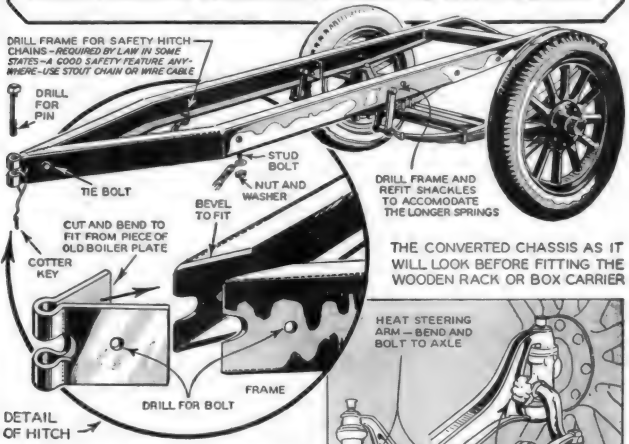
This will save a lot of stripping work later. However if your frame is not fully stripped remove all unwanted parts as indicated in the conversion drawing. It will be seen from this plan that the front end of the car becomes the rear end of your trailer.

The rear springs of most old cars are longer and more flexible than the front ones and therefore better suited for trailer purposes. Replace the front springs with the longer rear ones, using the same shackles placed to suit the spring length. This refitting job will vary somewhat depending on the car frame ob-

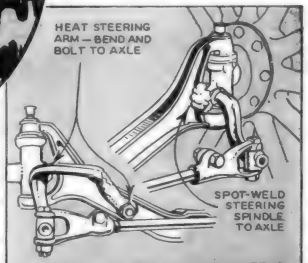
A GOOD FARM TRAILER



TRAILER CONVERSION SUPERIMPOSED ON TYPICAL OLD MODEL CAR CHASSIS



THE CONVERTED CHASSIS AS IT WILL LOOK BEFORE FITTING THE WOODEN RACK OR BOX CARRIER

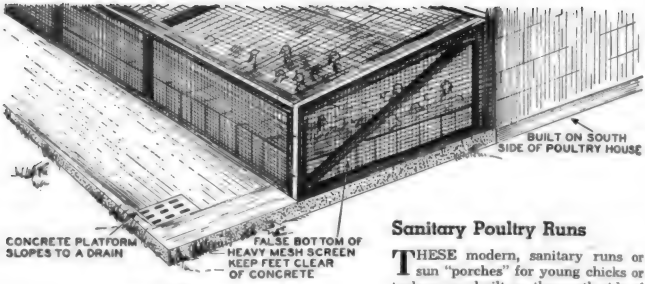


TWO METHODS OF SECURING WHEELS

tained but no special difficulties are presented in effecting the change regardless of the model. It may be desirable to remove one or more leaves for greater flexibility but this can be decided according to the average load you expect to handle in the finished trailer.

Before replacing the springs, cut off the frame members at any desired length

[*Continued on page 144*]



Sanitary Poultry Runs

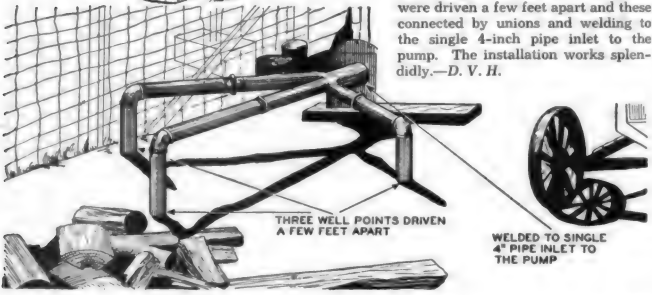
THESE modern, sanitary runs or sun "porches" for young chicks or turkeys are built on the south side of the poultry house on a concrete platform which slopes to a drain. False bottoms of heavy mesh screen keep tiny feet clear of the concrete.

Wire Reels From Oil Drums

EMPTY oil drums make excellent reels for barbed wire when taking down a fence. Being the same diameter at each end, they roll straight and, being hollow, can be moved easily, yet they will take a quarter mile of fencing without building up too many layers. —*D. V. H.*

Three Point Rotary Pump

A TRUCK farmer bought a small rotary pump at a sale for a good price. It was too large however, for a single point, so three well points were driven a few feet apart and these connected by unions and welding to the single 4-inch pipe inlet to the pump. The installation works splendidly.—*D. V. H.*



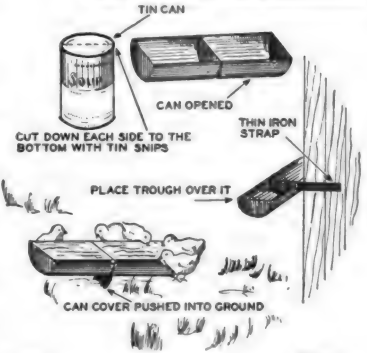
Headlight Case Digs Holes

THE shell or case of an old bullet type headlamp is very useful for excavating deep post holes. Weld the standard to the case and attach a long wooden handle. With this gadget it is a simple task to scoop out the dirt from the bottom of the hole. —*A. H. W.*

Soup Can Chick Waterers

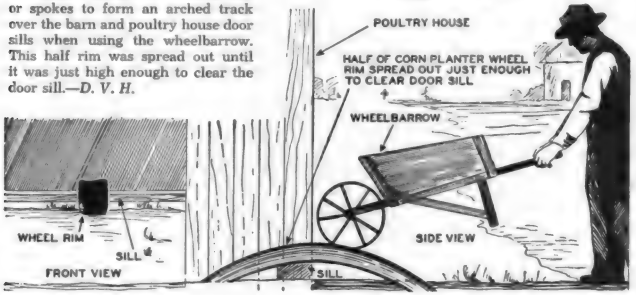
ANY tin can whose contents may be readily poured out, can be used. Cut down each side to the bottom with tin snips to make two equal halves. Bend these halves apart and lie flat as shown.

For watering dishes for small chicks, push a shingle end or large can cover into the ground and slip this into the space between the folded over bottom.



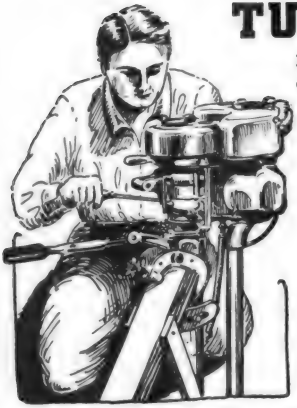
Corn Planter Wheel Makes Track For Wheelbarrow

ONE farmer uses a half corn planter wheel rim—without hub or spokes to form an arched track over the barn and poultry house door sills when using the wheelbarrow. This half rim was spread out until it was just high enough to clear the door sill.—*D. V. H.*



TUNING UP THE

For peak performance keep the ignition system of your outboard motor in tip-top condition.

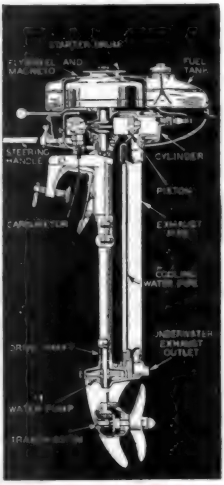


MOST often blamed component of an outboard engine when that engine develops trouble, and yet the one least likely to develop major defects, is the magneto used to create high tension current. Simple in principle and operation, almost trouble-free under normal conditions, it yet becomes the subject of suspicious scrutiny as soon as the motor balks, backfires or otherwise shows signs of misbehaving.

This attitude on the part of the owner can be traced generally to the fact that he knows little or nothing of how and why the magneto works; it's a mystery to him how that funny-looking collection of parts can produce the sizzling blue spark necessary for proper functioning of the engine. Yet the principle is simple enough, as is the practical use made of it; once understood, there should be no difficulty experienced in making one's own tests and adjustments.

Briefly, the magneto consists of a plate on which all components are mounted, called the armature plate, installed on the top of the crankcase in such position that it is partially concealed by the flywheel. The flywheel in turn has a permanent magnet mounted on its inside rim, circular in shape to follow the shape of the flywheel, and riveted solidly in place.

Mounted on the armature plate are the coil, breaker points, condenser and miscellaneous wiring. The coil consists of a laminated iron core terminating in laminated "heels," over which is wound a primary of comparatively few turns of coarse wire and a secondary of many turns of fine wire. The secondary is "split" in the case of opposed-twin cylinder motors; that is, a high tension lead is connected to each end of the winding and the center is tapped and grounded, thus allowing a simultaneous spark to both spark plugs. The breaker mechanism consists of a pair of tungsten points, one of which is grounded, and a lever arrangement for opening and closing the movable point by means of either a cam on the flywheel hub or a flat space ground on the crankshaft. The condenser is connected to the insulated point and of

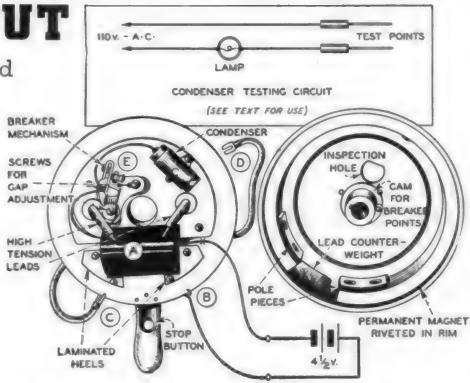


Left: Cross-section of a typical outboard motor, showing principal parts. Right: On some motors the breaker points can be filed with fine sandpaper or a point file through the inspection hole in the flywheel.

PUT-PUT

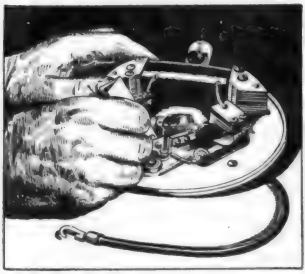
by A. C. Gould

Diagram at right shows parts and circuit of an outboard magneto. In box is a simple condenser testing unit. Dampness and oil seepage are the principal causes of ignition trouble.



course its metallic case grounds it to the plate.

This is the basic arrangement of all magnetos. Variations occur, of course; in some types of alternate-firing twin cylinder engines there are two coils, two condensers and two sets of points, with only one high tension lead from each coil; in other alternate-firing types a split secondary coil is used but with a simple arrangement for grounding each half of the coil except on the power stroke of the cylinder it feeds; on single cylinder engines, there is only the one high tension lead. The breaker mechanism may vary, too; on some engines the points are closed normally, opening momentarily to produce the high tension current, while on other types the normal position is open. But for all practical purposes we need consider only one type, and any variation of this in your own motor can be easily ascertained.



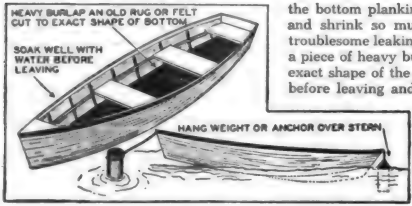
Removing the armature plate is the best way of getting at ignition parts. After tune-up be sure to clean out all dust and dirt before testing. Bathing the entire assembly in gasoline is helpful.

The various parts are connected as follows: One end of the primary winding of the coil is grounded, while the other end is connected to the insulated point of the breaker mechanism. High tension leads connect the secondary winding with the spark plugs; the return circuit here is, of course, through the ground made by screwing the spark plugs into the cylinders. The condenser is connected as described above, and another wire attached to the insulated point goes to a short circuiting button used to stop the motor.

Now, as the flywheel revolves, the poles of the permanent magnet pass closely by the laminated coil-heels, and a low-voltage current is set up in the primary winding of the coil through induction, the breaker points at this time being open. As this current builds up to a maximum, the points close, allowing completion of the primary circuit to ground, the inductive lines of force surrounding the secondary winding collapse suddenly, and a surge of high voltage current, the voltage depending on the number of turns of fine wire wound into the secondary, is induced in the secondary coil and circuits; this high tension current produces the spark at the plugs. The function of the condenser is to absorb any kick-back of energy from the secondary to the primary, which would rapidly burn and pit the breaker points; sort of a check-valve

[*Continued on page 132*]

NAUTICAL KNACKS FOR



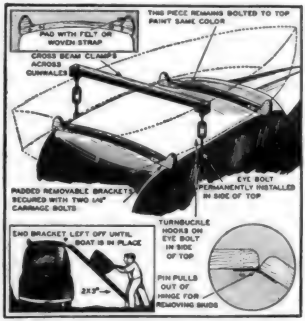
Preventing Rowboats From Leaking

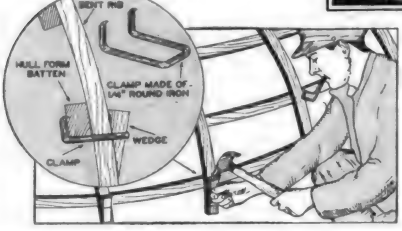
THE average flat-bottom boat that has to be left out of the water between usings invariably leaks when put back in because the bottom planking has had a chance to dry out and shrink so much that seams open up. This troublesome leaking can often be avoided by having a piece of heavy burlap, an old rug, or felt, cut the exact shape of the bottom of the boat. Put this in before leaving and pour several buckets of water over it. The cover will remain moist for a long time, especially in the shade, giving the wood beneath no chance to dry out.

Flat-bottomed skiffs, especially models with excessive rake at the stern, usually leak whenever used even though always kept in the water. The reason is that without anyone in the boat the planking at the stern is just out of the water and so has a chance to dry out. A weight out on a line over the stern when the boat is not in use will keep the seams tight.—*J. E.*

Boat Cradle For Car Roof

THIS neat boat cradle is best adapted to the older cars with fairly flat tops. The permanent cross members are of 1¼x1½-in. pine or oak bolted through the car top. Padded removable brackets on the ends form a cradle for the boat to be transported. Skids, by means of which the boat is slid from the ground to its cradle, are attached by hinge pins, as shown. When the boat is in place the skids are detached by taking out the hinge pins. They are then carried either in the boat or on the side of the car. With this rig two men can easily slide a fair sized skiff on and off the roof. With more and more rowboats being built of marine plywood, and hence kept out of water, car-top cradles will probably become increasingly popular.—*H. S.*



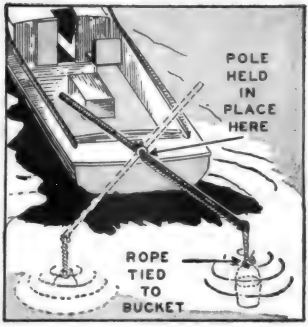


Simple Clamp For Boat Builders

THE expense of a large number of C clamps can be avoided by the use of this simple wrought iron bracket. Not only is it less expensive than the C clamps, but has the advantage of not sticking out from the hull and can be quickly adjusted.—*H. S.*

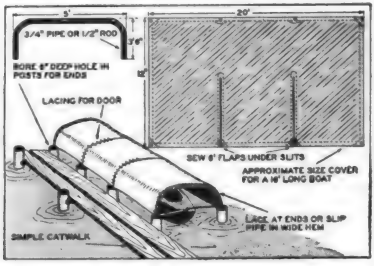
BOAT FANS

How To Rig A Jury Rudder



IF YOU lose your rudder or the steering gear becomes disabled a jury rudder as shown will enable you to get back into port. Use as long a pole as possible, a heavy boat-hook, an oar, a short spar if your boat has a sailing rig, a military mast on a cruiser, or even several lashed together floor boards. Pivot this over some fitting on the after deck, preferably exactly amidships and as far aft as possible; such as a chock, cleat, or lifting ring.

Have a little more than half your pole inboard and attach the rope in such a way it cannot slide, as there is considerable pull at this point. If you can find a few odd nails aboard drive a couple astern the rope. Next tie a bucket, a stove-in gallon oil can, or anything that will exert a drag on a line to the end of the pole long enough to let it drag astern without the inboard end of the pole being too high in the air. Start up the engine and do not go too fast.—*J. E.*



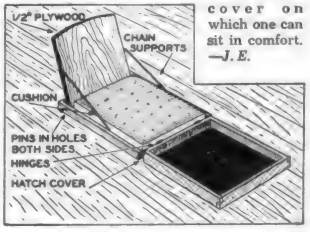
Canvas Boathouse

THIS simple run-in boathouse is made up of four rods or pipes bent as shown so their ends can be slipped in holes in the tops of posts driven in the bottom of the river or lake. These posts should be spaced in keeping with the size of the tarpaulin used—20 x 12-feet is right for the average 14- or 16-foot boat. Have grommets around the edges of the tarp and two reinforced sections worked in, so the center can be rolled back to permit getting in and out the boat.

The simple catwalk alongside is necessary, of course, to get to the boat.—*J. E.*

Hatch Cover Forms Seat

THIS little seat on the forward deck makes the most comfortable place imaginable from which to watch the shoreline slip by. Any boat with the usual forward hatch can have it; simply arrange the hatch cover with hinges to swing back down on the deck, perhaps on top of rubber pads or rubber headed screws, then cut a piece of ½-inch plywood, as shown, for the back and bore through the outer lips of the cover 3 inches into the plywood each side to take metal pins a loose fit. A cushion fits inside the lips of the cover on which one can sit in comfort. —*J. E.*



Why Electrical Power Lines

AN EXTREMELY important feature of house electrical circuits, not generally understood or appreciated by home owners, experimenters, radio amateurs, etc., is that practically all a.c. wiring, if installed according to the National Electric Code, is *polarized*. Many persons are badly shocked—and killed, too—because of faulty extension cords nailed to walls and baseboards by well-meaning family handy men who do not carry out the polarized system correctly. Improper extensions in the bathroom, the kitchen and the laundry are particularly deadly because wet hands and exposed pipes make for perfect "grounding" conditions.

Many people are confused by the term "polarized" as applied to a.c. circuits because they know that alternating current by its very nature changes its direction of flow 120 times a second (for standard 60 cycle current). They know that direct current lines have a positive and a negative side, and when they try to think of alternating current in the same sense they naturally are puzzled.

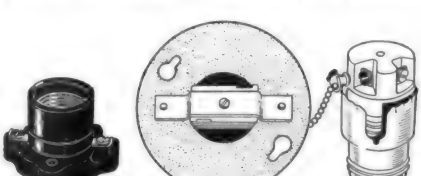
The word "polarized" refers to a very simple method of identifying all parts of a circuit. In any polarized system the two power wires are colored differently; in standard BX (armored cable) and fixture wires the insulation on one wire is black and on the other white. Flexible cords have a colored tracer in one lead, or next to one wire is a white tracer string. From the service wires as they enter the house, to the remotest attic light, all splices are made white to white and black to black. At the switch or meter box the white wire is connected by a heavy jumper to the nearest and best actual "ground," invariably the cold water pipe where it enters the house. The BX (or other metal pipes carrying the power wires) is also grounded in this manner, and all the mechanical mounting of switch boxes, junction boxes, base outlets, etc., is done in such a manner that all these metal parts are in good electrical contact with each other, maintaining an unbroken, grounded exterior sheath for all wires.

Sockets, duplex receptacles, etc., have two screw connections, one plain brass, the other "silver" colored. The white wire in all cases goes to the silvered terminal, and the white connection continues without interruption by fuses or switches throughout the house. The fuses and various wall switches are cut into the black wires, *never the white*.

Short of placing the fingers deliberately into a socket, this system of continuous grounding protects people against most accidental shocks. The one weakness with it is that the protection really ends at any wall receptacle, because, while the receptacle and its wires are properly polarized, the standard attachment plugs are not; they can be put in two ways. The trouble starts when a man extends the circuit from that receptacle by means of lamp cord held to the wall with staples, and en route loses the identity of the grounded wire. Of course, it should be pointed out that wiring of this kind is highly illegal and invalidates most fire insurance policies almost automatically, but the country is full of it just the same. If you *must* run twisted-pair wire all over the house, at least polarize it correctly.

With dish washers, washing machines, electric ironers and similar machines that are usually installed in basements, danger of shock can be removed by the use of polarized receptacles and plugs. The latter differ from ordinary plugs in that the prongs are at right angles to each other, instead of parallel. Corresponding T shaped slots in the receptacles

Left: An ordinary attachment plug. Right: A polarized plug. Note that the right-hand prong is at right angles to the other one.



Sockets and receptacles of all kinds have one screw silvered, the other plain brass finished. The silvered one in all cases takes the white (ground) wire.

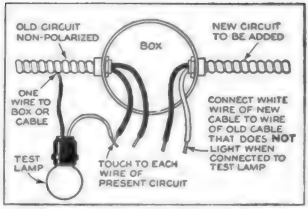
Are "Grounded"

by Harold Henrys

permit the plug to enter only one way. It is then a simple matter to connect the white-marked wire in the appliance's flexible cord to the prong that makes contact with the receptacle spring already connected to the white wire of the power line. At the machine itself, the white wire continues to one side of the motor, heating coil, etc., with a tap taken off to connect to any nearby mounting screw on the metal frame, thus "grounding" the appliance correctly. The on-off switch is, of course, connected in the black wire, in accordance with standard practice.

If the machine should now become grounded accidentally, through contact with a nearby water, gas or steam pipe, or because of water slopping off it to the floor, nothing happens to the operator, because it is already grounded anyway. An actual breakdown of the live wires inside the machine will simply blow the line fuses. However, without correct polarization throughout the system, an accidentally grounded machine in wet surroundings is likely to "leak" electrically, and sting the person touching it.

With some types of heavy-current machines which are used in the presence of water, the grounding precaution is carried out even more thoroughly by the use of special three-connection outlets and three-prong plugs that will fit them only one way. Two

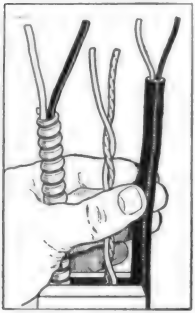


How to "polarize" a new extension cable when the old cable has two black wires.

of the connections carry power to the appliance in the usual manner. The third serves only as a grounding medium. At the machine end it is grounded to the framework; the corresponding contact in the receptacle is grounded by a short jumper to the receptacle box and its associated conduit. These three-prong plugs and receptacles on ordinary two-wire house installations puzzle many men who think they are familiar with electrical circuits. They invariably guess that the three wires represent a 220-volt service with grounded center, and they are completely stumped when they are told there are only TWO wires in the BX that brings power to the receptacle.

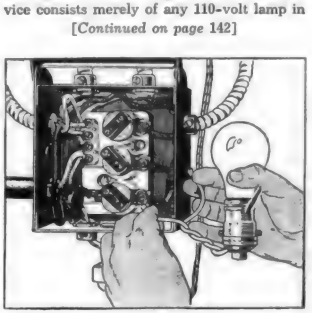
It is a very simple matter to identify the grounded and "hot" sides of a house circuit when extensions are to be run. If by chance the wiring (in an old house) is non-polarized, as indicated by the presence of two black wires, all new wiring should be polarized to conform with the new system. The test device consists merely of any 110-volt lamp in

[*Continued on page 142*]

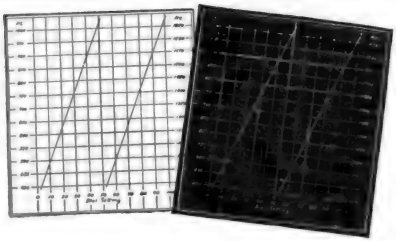


Left: Electric power wires are identified in some way. Armored cable (extreme left) has one wire with white insulation, the other with black; heavy rubber covered flexible cord (extreme right) is likewise colored. Twisted pair lamp cord (center) usually has a tracer in one wire. The white or tracer wire is always the "ground" side of the circuit.

Right: Testing for the live and grounded sides of a power circuit by means of bulb with probing wires. The latter should be well insulated.



"Blueprints" Made Easily By Contact Printing Method



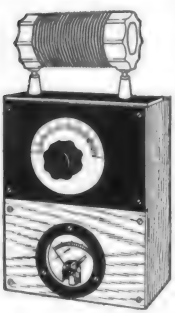
RADIO experimenters who have friends who are amateur photographers, or are themselves camera fans, too, may find it helpful to combine these hobbies on occasion. For example, handsome "blueprints" of circuit diagrams, calibration curves, etc., can easily be made by making an india ink drawing on tracing paper, then contact-printing on a contrasty paper. The results are better than the finest actual blueprinting, because of the vivid contrast between blacks and whites. By first making a paper contact negative, it is also easily possible to make black-on-white prints. The latter trick is useful in making special radio dial plates, since a glossy paper by transmitted light gives somewhat the same effect as the plastics ordinarily used for this purpose.

The only point to remember in this process is that the emulsion side of the printing paper

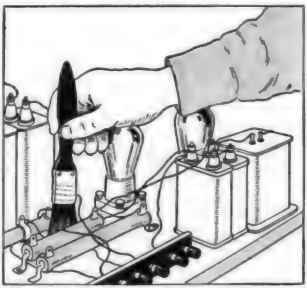
[*Continued on page* 144]

Economical Panels

IN EXPERIMENTAL short-wave receivers, transmitters and power packs, it is not necessary to use expensive Bakelite or other insulating materials for all the panels. Comparatively few parts actually carry high voltages or need to be protected against r.f. leakage. It is, therefore, quite practicable to use simple and inexpensive wood construction, with Bakelite or ceramic insulation placed only where essential. For instance, in the small transmitter unit pictured at the left, the plug-in tank coil and its accompanying tuning condenser are mounted on small Bakelite panels, but the rest of the structure is ordinary ¼-inch plywood. The plate milliammeter, which carries its own insulation, fits in a hole in the bottom section. Incidentally, it is much easier to cut and drill plywood or "pressed wood" materials than Bakelite. Fasten the panels with short wood screws.

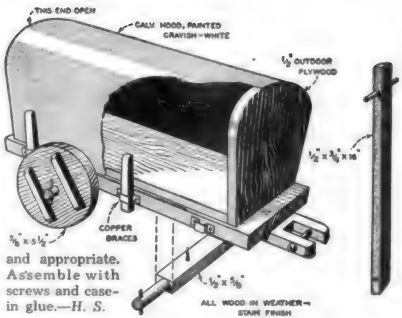


Keeping Chassis Clean



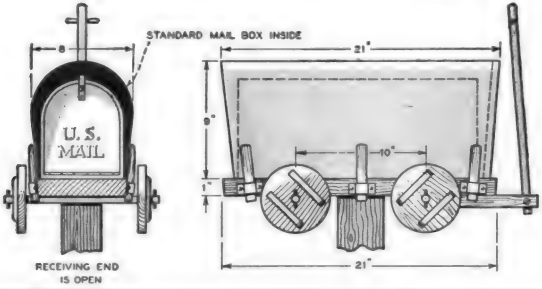
DUST and dirt that settle in tight corners of radio receivers and other equipment can be removed quickly by means of an ordinary small paint brush. Use a cheap, new one that has never been actually employed for painting. The one-inch size is just about right.

"Covered Wagon" MAIL BOX



THIS trim mail box in covered wagon form encloses one of the standard R.F.D. boxes, and adds an interesting touch to the home place. Incidentally, you can tell your callers to pull up at the "Covered Wagon" as an easy means of identifying your home.

Construction is all wood except the galvanized hood, and a weathered finish is effective and appropriate. Assemble with screws and case-in glue.—*H. S.*

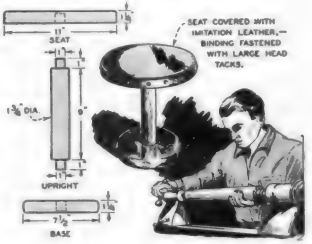


KNOCKDOWN STOOL

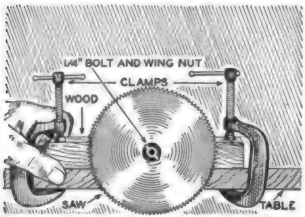
THIS knockdown seat has several broad uses. It can be used within the house in any room for those occasional times when the house is crowded and all the chairs are taken. Compact when knocked down, 4 of them will fit into a mighty small space in the car, yet they are put together in jig time at picnics or outings.

Turn a disc 11-in. in diameter from 1¼-in. thick white pine or gum stock with the edge well rounded. While still in the lathe, cover the top with imitation leather drawn tight and tacked at 1-in. intervals. These tacks are then covered with binding strip held in place by upholstering tacks and the waste finally cut off flush with the bottom surface of the top.

The base is made as shown and given a good coat of spar varnish. The upright has snug-fitting tenons at the ends, slightly tapered so they will enter the holes easily.—*D. V. H.*



Helpful Hints For



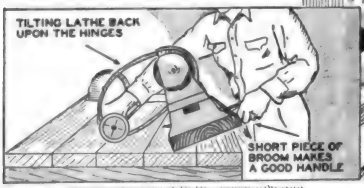
Saw Sharpening Vise

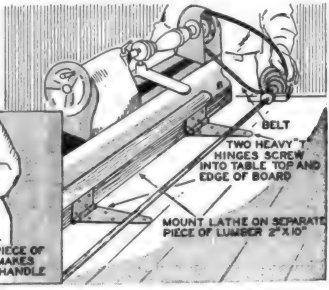
A PIECE of wood two inches longer than the diameter of a circle saw, with a ¼-in. hole bored in the center is all that is needed to hold a circle saw securely while filing and swaging. The setup is fastened to a shelf or table top with two clamps, or it may be mounted with screws, taking care that the piece of wood is parallel with the main support. Washers, bolt and wing nut complete the outfit.

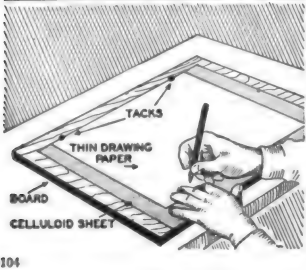
Handy Lathe Mount

SOMETIMES it is convenient for the home craftsman to take power for his lathe from a fixed line shaft.

An excellent arrangement, in this event, is to mount the lathe on a separate piece of lumber measuring 2 by 10-in. and running the length of the lathe bed, as shown below. Screw two heavy "T" hinges into the table top and into the back edge of the 2 by 10. Merely by tilting the lathe back upon the hinges, enough slack is gathered to shift the belt on the two cone pulleys easily. On the left hand side of the mounting board as you face the lathe bore a hole 1-in. in diameter on the outside edge. Glue a short piece of broom handle into the hole and you will have a convenient handle for tilting the lathe.—*G. E. B.*







Celluloid Protects Paper

THE writer uses a sheet of fairly thick celluloid (bought from a car top repair shop which keeps a stock to repair old touring car windows) under thin drawing paper to prevent the sharp pencil point from breaking through the paper.

This sheet is a little larger than the paper sheets used and two thumb tacks placed in the usual way, hold both sheets firmly in place. This makes for cleaner, sharper sketches and drawings. The sheet also permits tracing of an original, or a blue print through thin tracing paper.—*D. V. H.*

The Home Workshop

Simple Way To Cut Glass

ANY grade of glass can be cut with an ordinary ten-cent glass cutter. The secret of using glass cutter is not in the cutter, but in the glass itself. Grease or dirt on the glass will prevent a smooth, continuous scratch. Make certain that the glass is clean. After the scratch has been made, break the glass quickly over a straight edge. If the scratch it curved, tap the glass along the opposite side until it cracks along the cut. Whatever method is used, do not delay breaking the glass after it has been scratched, since the cut more or less heals if it is allowed to stand for any length of time.

Where a clean circle is desired, score the glass with radial cuts, as shown in Fig. (2). Larger circles or circular arcs can be cut with arrangement shown in Figure (1).—*R. F. K.*

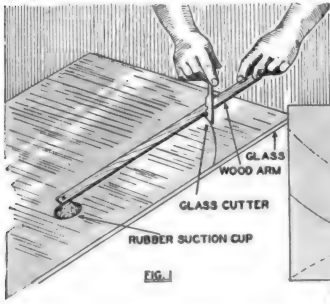


FIG. 1

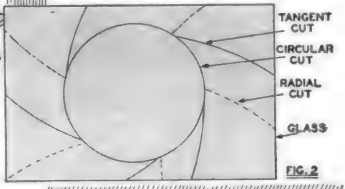
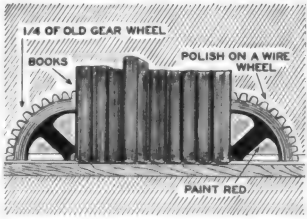


FIG. 2



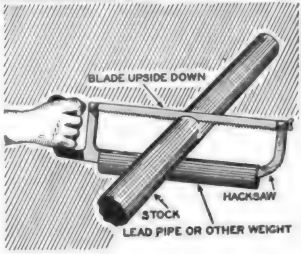
Old Gear Makes Book Ends

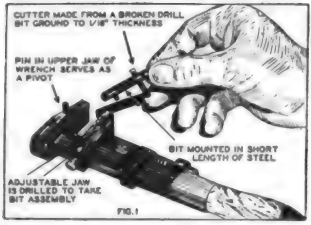
VERY appropriate book ends for the home mechanics library or the shop office desk can be made out of an old gear wheel. The gear is sawed in two, and one of the halves is sawed in two again, making two segments of a quarter of a wheel each. Two pair of book ends can be made from one wheel if desired. A rather heavy wheel should be used. Polish with wire brush.

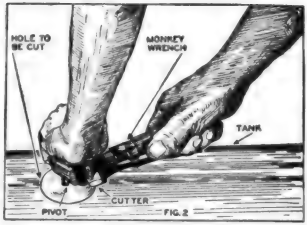
Weight Hack Saw For Cutting

BY TURNING the hack saw blade upside down, then weighting the back of the frame with lead or other weight, heavy cutting through large diameter rods and bars is speeded up and made into a fairly easy one-man job.

From 5 to 20 pounds may be applied, either by sliding a large lead pipe over the frame to make a snug fit, or by fastening lead or other metal to the frame with clamps.—*D. V. H.*

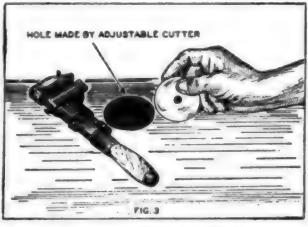






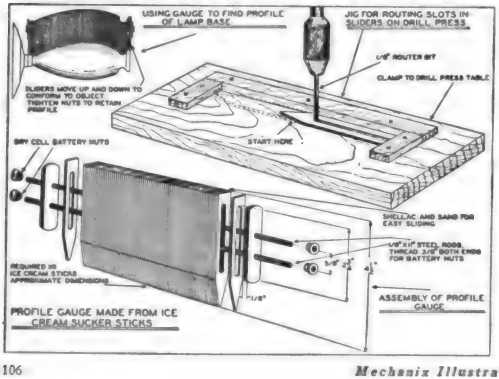
CUTTER FROM WRENCH

A MONKEY wrench may be easily altered to cut clean, smooth holes in heavy tanks or sheet iron. A pin, put in upper jaw of monkey wrench serves as a pivot. The cutter is made from a broken drill bit, ground to $\frac{1}{16}$-inch thickness and mounted as shown, in a short length of steel. Adjustable jaw is drilled to take bit assembly. The small pin projection keeps assembly in line. When adjusted the small thumb screw is tightened to keep the cutter in exact adjustment.—*Benj. Nielsen.*



UNIQUE PROFILE GAUGE FOR THE SHOP

A PROFILE gauge will be found very useful for any home work shop enthusiast who desires to duplicate the shape of any object such as a chair leg, lamp base, moulding, etc. The drawings show the construction of such a tool easily made from a number of ice-cream sucker sticks, or lacking these, pieces known as sliders cut from any thin wood. Cut pieces to shape shown and route out the $\frac{1}{2}$x2$\frac{3}{4}$-in. slot on drill press.

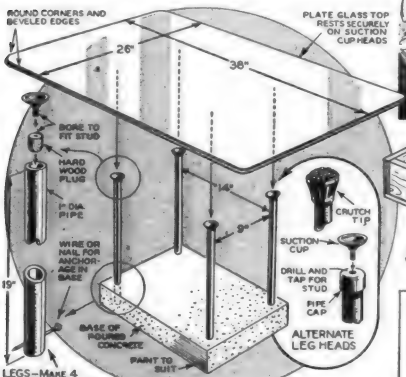


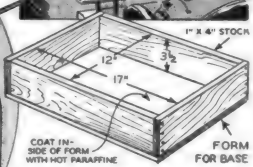
Assemble sliders on two $\frac{1}{8}$x11-in. brass or steel rods, with clamp blocks and battery nuts.

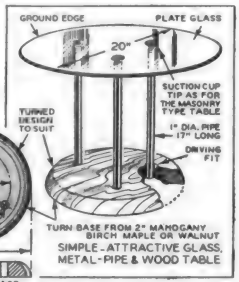
To use, loosen two of the nuts, move the sliders so as to conform to the profile of the object being duplicated. Tighten the nuts and you have your profile.—*J. J. Wenner.*

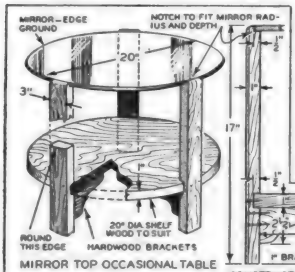
GLASS-TOP TABLES

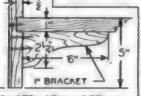
With Masonry or Wood Bases











THESE tables are as modern as this morning. What's more, unlike much of the metal-glass furniture, they are easily made without need of special knowledge, skill or tools.

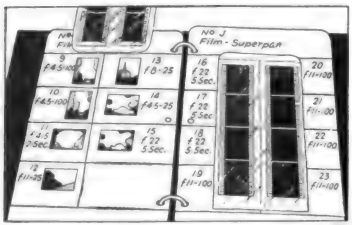
With a heavy but small concrete base, copper or nickle-plated pipes for the legs and a single plate glass top, the design at the top of the page is almost absurdly simple. But it looks well and will be found not out of place in the living room, bedroom or den.

To really make the table rigid, suction rubber cups are provided for the top of each leg. Thus an accidental bumping of the top won't dislodge or even budge it.

The base comes first. Build a form of 1x4-in. boards (whose net widths are 3½-in.) and give the top, bottom and inside surfaces a liberal coat of hot paraffin to seal the wood.

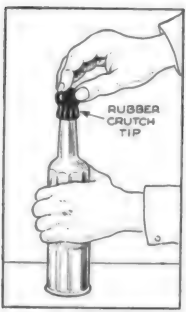
[*Continued on page* 145]

Kinks for Photo Fans



ABOVE: Make this efficient file with transparent envelopes and a loose-leaf book. Divide book as shown, record exposure in section corresponding to negative and paste contact print under negative. Negative envelopes are held in place by gluing their flaps to each loose-leaf page.—A. Ocker.

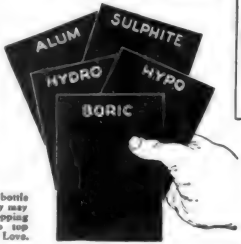
BELOW: A discarded leather case from an electric razor or similar article makes an ideal accessory carrying case. Cut two slits in back of case and slip onto your trouser belt as shown.—R. Kaiser.



ABOVE: Rubber crutch tips are good bottle seals. Available in the five and dime, they may be obtained in several sizes to suit. Dropping marbles in bottle brings solution to top of bottle as chemical is dissipated.—E. Love.

ABOVE LEFT: Make a printing frame from a film pack adapter by cutting clear glass and plywood to fit adapter. Plywood holds paper and negative against glass by means of tension spring in adapter lid.—K. Murray.

BELOW: Slides on which to measure chemicals can be made from black paper from cut film packages. Identify them with white ink to prevent contaminating chemicals.—L. Robbins.



ABOVE: A square of sponge rubber will ease the labor of hand agitation. Resilience of the sponge rubber bounces the tank with a minimum of effort.—M. Knowlton.

Ferro Tins from Sheet Metal

Above left: Any standard gauge piece of sheet metal is suitable for conversion into ferrotyping tins. Such tins must first be cleaned thoroughly. Above center: The tin is next coated with a high gloss, hard drying enamel, preferably a product with Bakelite in it. Above right: After the paint or varnish coating has dried, the tin is ready for use. (Two coats of paint are sometimes necessary if surface is rough.)

by C. K. Cameron

FERROTYPING is one of the simplest phases of photo finishing, and if these easy instructions are followed there is no reason in the world why the rankest amateur cannot obtain first class results. Squeegeeing—or ferrotyping, to be slightly professional about it—is the one part of home camera work that can compensate to an astonishing degree for prints that are over or under exposed or developed.

There are three types of surfaces that might be used in ferrotype work—standard enameled or japanned plates, chromium-plated metal, and plate glass that has not been spoiled by polishing with abrasives. Regardless of which is used, however, the general operating technique is the same. And of course, the prints must be made on glossy paper every time.

Enameled plates can be purchased fairly reasonably from any photo house. The photographer who makes very many prints at a time may save money by making his own. A sheet of old sign metal or sheet iron, or any similar material that does not buckle or dent easily, will serve.

Clean the sheet metal thoroughly. Use paint or varnish remover if needed. Wash off with turpentine, then eliminate the turps with soap and warm water. If it seems advisable, scrub with Grade 00 steel wool. The metal *must* be clean, greaseless, dry, and perfectly smooth before coating.

The required finish can be obtained with any good grade of regular auto enamel, or resin-base enamel. Color is immaterial, although for some reason the commercial ferrotypes are always a most funereal black.

Apply the enamel with an old brush that is whiskerless and well worked. New brushes usually shed enough to ruin the perfect surface needed for glazing prints. If convenient, the enamel may be sprayed.

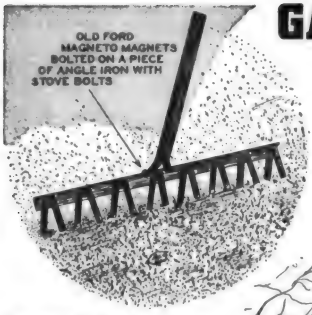
Allow the first coat to become completely dry and hard. This admittedly is contrary to usual practice, but it is indicated by actual experience in making plates. Care should be taken to protect the enamel from dust while drying. Rub the surface down with fine steel wool. Work from various angles to keep from scoring the surface or developing a "grain."

Apply a second coat and allow plenty of time to harden. If there are any lumps, pits, or other flaws, work these out with steel wool. It is not necessary to work toward a glossy enamel finish—smoothness is the essential. Sometimes, depending on the basic metal and the enamel used, a third coat might be needed.

The last step in preparing the plates is wax-polishing them. Mix two ounces of gasoline and 20 grains of shaved paraffine wax. Twenty grains are not very much—it takes 437.5 grains to make one ounce. If it is not convenient to weigh the material, just add a few parings from a cake of canning or ironing wax. Don't be too generous with the wax—this is important, since a paring or so too much will entirely ruin the polish.

This solution may be used on purchased plates too, of course. Likewise, purchased polish may be used on either type of plate. Glass plates will absorb quite a little of the liquid, strangely enough, although it should be applied in very small quantities.

GARDEN HINTS

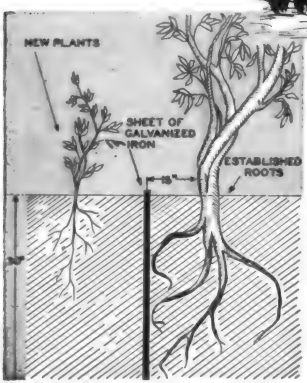


Magnetic Garden Rake

A MAGNETIC rake that is very useful for picking up small pieces of metal from gardens and gravel driveways can easily be made in a short time. The teeth of the rake are constructed of old Ford magneto magnets, obtainable at any junk yard. Bolt the magnets to a length of angle iron with stove bolts, as shown at left. Addition of a handle completes the rake.—*Frank Lancaster.*

Attractive Walk-In Well House

OF STRIKING design, this well house is adapted to home grounds boasting a pump which needs to be hidden. A three-sided wall of limestone is first laid up about the pump and platform, then on this mount four 4x4-inch pieces which support the shingled roof. Roof is green, other woodwork white.—*D. V. H.*



Protecting New Plants From Established Roots

IN THE case of annuals, particularly when of the climbing variety, such as sweet peas, the home gardener often wishes to plant very close to a wall or fence which is already covered with perennial vines. In order to give the seedlings plenty of nourishment, and get the roots well started it is desirable to prevent the established vine roots in the soil from crowding the newly planted section.

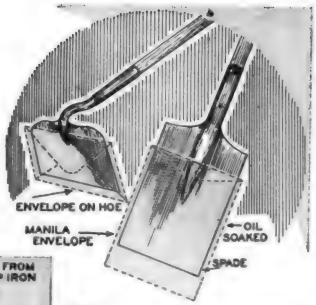
A good way to keep the old roots separated from the new is to sink sheets of galvanized iron in the ground between the plants to a depth of two feet or so. This method has been found especially successful on the Pacific Coast in checking the rapidly spreading root-mass of bamboo clumps.—*Hi Sibley.*

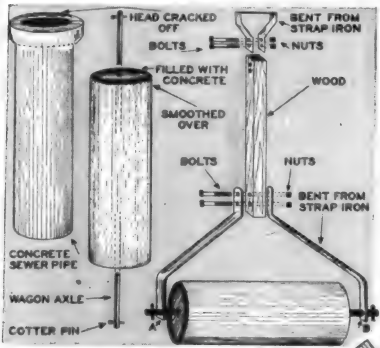
FOR SPRING

Envelopes Keep Hoe And Shovel From Rusting

SPADES, hoes and shovels may be easily kept from rusting for long periods by the simple expedient of slipping an old envelope to fit, over the edge, after the paper has been oil soaked.

Pour a little oil in the envelope, stand it right side up for an hour or so and the paper will be thoroughly soaked.—*D. V. H.*



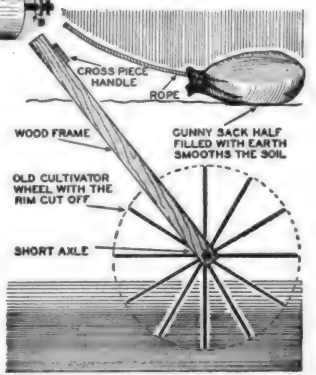


Wheel Aids Transplanting

A TRUCK gardener cut the rim from an old cultivator wheel, then mounted this on a short axle with handle to locate accurately the spots at which the dibble was inserted for transplanting. The method is variable and the plants can be spotted at any desirable interval by merely cutting off more or fewer of the spokes. Thus the original diameter of the wheel is not of importance. Smooth the soil first with a sack of earth.—*D. V. H.*

Concrete Pipe Lawn Roller

ANYONE can make this efficient lawn roller for his home. The materials used are easily obtainable. The roller is made from a length of concrete sewer pipe purchased from any pipe yard. The flange is cracked off, and the pipe filled with a mixture of sand, gravel, and cement. Before the concrete has hardened, half of a discarded toy wagon axle is forced into the mixture at both ends. It must be in the exact center. The handle, to be used after the roller has hardened in the center, is shown in the sketch above. The wood stock should be varnished and the metal parts painted with aluminum paint. This will lengthen the life of the materials. Also, a heavy application of axle grease at points A and B will eliminate wear, and make for easier pulling.—*Rodney A. Ahner.*



FOR BETTER FINISHING

Sanding on flat surfaces should always be done with the sandpaper wrapped around an oblong block of wood. Move the hand in a brisk, circular motion.

Many a splendid piece of home woodworking has been ruined by improper finishing, to the despair of its creator. The information contained in this article will help home craftsmen turn out professional-looking jobs, and the important points are presented in convenient chart form.

by Roy F. Kaiser

FINISHING . . . the headache to most home craftsmen. What shall I use? What should I do first? Shall I sand, shellac, varnish or wax?

All these questions are always in the minds of craftsmen when before them stands a perfectly modeled piece of work, beautiful but easily spoiled through lack of proper finishing. The charts shown on these pages solve this problem so perplexing to most of us. By noting the characteristics of the commonly used woods mentioned, and following in successive steps the information given, a perfect job of finishing can be obtained. These charts if cut out and hung in the workshop will prove an invaluable aid.

So you will better know the most common types of woods, their characteristics and uses, the data below is given to assist in the selection of these woods for particular jobs. After checking over the various woods, studying their characteristics, the next important step is to know the methods of finishing. This term applied to wood means the staining, filling, oiling, shellacking, varnish-

KINDS OF WOOD	CHARACTERISTICS OF WOODS			
	GRAIN	TEXTURE	WEIGHT	USE
ASH	Close	Tough, fairly coarse. Difficult for hand tools	Medium heavy	Interior trim, tool handles, boats, ball bats
BASSWOOD	Fine, close, small	Medium to soft. Often beautifully figured	Medium	Cutting boards, table tops, trim, models
BIRCH	Very close, straight and compact	Fine. Satiny lustre	Heavy to very heavy	Fine furniture, trim, flooring, veneers
CEDAR (WHITE)	Close, fine and brittle	Fine, fairly soft and uniform	Light	Shingles, furniture, trim, chests, boats
CHERRY	Fine, figured and waved	Close and hard. Takes high polish	Quite heavy	Furniture, joiner work, novelties
EBONY	Fine	Color black, straight grain, very dense	Very heavy	Fine furniture, overlays, expensive trim
GUM (RED)	Cross, spiral and interlocking	Very fine and figured. Beautiful when quarter-sawed	Medium to heavy	Siding, moulding, veneers, furniture
HICKORY	Fairly straight, tough and elastic	Somewhat coarse and open grained	Very heavy	Tool handles, skis, boats, sports equipment
MAHOGANY	Interlocked or spiral	Fine to medium, handsomely figured	Heavy	High grade furniture, boats
MAPLE (HARD)	Generally straight	Fine, close and hard. Takes high finish	Heavy	Furniture, flooring, trim. Fine for turning
OAK (WHITE)	Very coarse	Usually hard, strong and tough	Heavy	Used in everything from ships to toothpicks
PINE (WHITE)	Close, fine	Compact and soft	Light	Every form of carpentry and boat building
PINE (YELLOW)	Coarse and varying	Comes in both soft and very hard, tough grades	Medium to heavy	House construction flooring, boats
POPLARS	Fine, straight	Usually even, fairly soft, not very strong	Very light	Veneers, panelwork, toys, trim, siding, woodcarving
REDWOOD	Coarse and straight	Compact, clear, soft, easily worked	Medium to light	Shingles, siding, floors, trim, furniture
SYCAMORE	Strong, tough hard	Fine to coarse. Beautifully figured when quarter-sawed	Fairly heavy	Fine furniture, drawer slides, drawers
WALNUT	Strong, hard, straight	Coarse to very fine. Has high natural lustre	Heavy	All types fine furniture, veneers. Excellent for turning

METHODS OF FINISHING WOODS

KINDS OF WOOD	PLANE & SCRAPE	SANDING	SPONGE & RE-SAND	WATER - STAIN	OIL - STAIN	SHELLAC WASH	DUSTING	PASTE FILLER	SAND, DUST, CLEAN	WHITE SHELLAC	MIXED SHELLAC	SAND 4/0 PAPER	CLEANING	RUBBING VARNISH	SANDING	DUST & CLEAN	FLAT VARNISH	RE-VARNISHING	RUB WITH PUMICE	POLISHING	CLEANING	SEALER OR PRIMER	LACQUERING	RE-LACQUERING	RUB & CLEAN	POLISHING	WAXING
ASH	X	X	X	X	/		X	/	X	/		X	X									/	/	/	/	/	
BASSWOOD	X	X		X	/					X		X	X		X	X	X	X			X						
BIRCH	X	X	X	X	/			/	/	X		X	X	X	X	X		X	X	X							
CEDAR (WHITE)	X	X		X	/					X		X	X	X	X	X	X	X			X						
CHERRY	X	X						/	/				X									X	X	X	X	X	/
EBONY	X	X					X	X	X	/		X	X	X	X	X		X	X	X	X					/	
GUM (RED)	X	X	X	X	/			/			X	X	X	X	X	X	/										
HICKORY	X	X		X	/		X	/	X	X		X	X					X	X	/						/	
MAHOGANY	X	X	X			X	X	X	X		X	X	X	X	X	X		X	X	X						/	
MAPLE (HARD)	X	X	X	X	/		/	/	X		X		X	X	X			X	X	X							/
OAK (WHITE)	X	X	X	X	/		/	/	X		X		X	X	X			X	X	X							/
PINE (WHITE)	X	X		X	/	/	X	/	X	X	/	X	X					X	X								
PINE (YELLOW)	X	X		X	/		X	/	X		X	X				X	X	X									
POPLARS	X	X	X	X	/					X		X	X	X	X	X	/	/									
REDWOOD	X	X		X	/		X				X	X				X	X	X									/
SYCAMORE	X	X	X							X		X	X	X	X	X			X	X	X						
WALNUT	X	X		X	/		X	X	X		X	X	X			X	X	X								/	/

NOTE: OPTIONAL (/) (FOLLOW STEPS IN SUCCESION)

These handy charts tell you the characteristics of 17 widely used woods, and the proper successive steps to take in finishing each. Cut them out or copy them, and mount on the workshop wall where they can be readily consulted.

ing, lacquering, waxing, painting, guilding and the like. The purpose of finishing is to bring out the natural finish of the wood and to protect it against weather conditions and wear. Going over these points in brief form, we find:

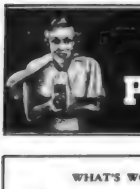
Sanding—

The operation of greatest importance which cannot be emphasized enough is the proper preparing of the surfaces to be finished. No material will hide the defects in the work. On the contrary they will only accentuate them. Therefore the surface must be perfectly smooth and by this is meant that it must be free from any mill marks, chipped or wavy indentations and even sandpaper scratches. Sandpapering machines are handy ones to have in the workshop, but the final sanding should be done by hand, working down to the finest grade of sandpaper, usually 4/0. Where the work is in rather poor condition start with No. 1½ and work down to 4/0 for the finish. Use a sandpapering block as this insures flat surfaces.

There are four different kinds of stain—water, acid, spirit and oil. Oil stain is the easiest to apply and leaves the surfaces smooth but does not penetrate as deeply or give as clear a color as the other stains. Water, spirit and acid stains give clear, lasting colors, but are more difficult to apply and tend to raise the grain. Stain should always be applied liberally by brushing or by better still, dipping. The surplus should be wiped off with a rag to prevent spotting. If the grain has been raised by some of these stains, a thin coat of shellac will stiffen the fibres which can then be sanded smooth with 4/0 sandpaper.

If the wood you are finishing is of a porous nature, these pores must be filled with a paste wood filler. [*Continued on page 146*]

Lacquer should be applied in one direction only, varnish lightly criss-crossed.



AMATEUR PHOTO PUZZLERS

WHAT'S WORRYING YOU?

Do you have any questions on photography you wish answered? Our photographic expert has a lot of information on his chest which he will be glad to dispose of for the asking. You don't have to be a subscriber or privileged character if it's photo information you want. This department is here to help you. So if there is any problem about developing, printing, processing or picture taking that bothers you, write to the photo editor. *Caution:* We can't criticize your prints and we can't inform you on a subject that requires a book-length explanation. Please enclose a self-addressed, stamped envelope with your question.

1. TABLE TOP PHOTOGRAPHY

Q. I am interested in taking table top pictures. What type of camera is best suited for this work and what other equipment is necessary?—Sidney White, New Rochelle, N. Y.

A. Table top pictures are best taken with a ground-glass back camera. This type of equipment will enable you to focus close-up to the table top object and also enable you to better judge how the setting looks through the camera lens. The only other equipment required is one or two lights in reflectors, depending on the effect desired.

2. NO IMAGE ON FILM

Q. I recently developed some film with the result that the film came out of the developer without an image. Then when I took it to the light, it turned a dirty grey. What caused this?—Joseph Crouse, Severn, Md.

A. If no image appeared on your film, it may have been due to (1) gross under-exposure of the film with the result that no image appears to speak of; (2) there may have been an active chemical lacking in your developer. The film turned grey (fogged) when taken to the light because (1) you failed to fix it in a hypo fixing bath after removing it from the developer; (2) the safelight in your darkroom was unsafe.

3. CONDENSING LENSES IN ENLARGERS

Q. I am building an enlarger from plans which appeared in Mechanix Illustrated. If I use condensers, should I use one lens or must I use a pair? What should be the position of the condensers in relation to the negative? If I use condensers, should I also use a diffusion glass?—M. D. Blaine, Garden City, Long Island, N. Y.

A. It is always desirable to use a condenser in your enlarger. Its major advantage is in collecting the rays of light from the lamphousing and concentrating them in a strong beam through the negative. Condensers should be of the same focal length as the lens being used in the enlarger and a pair must be used together. Position of the condensers in relation to the negative usually varies in different enlargers, but in most instances the condenser is placed as near to the negative as possible. In some enlargers the condenser sets flush against the negative; in others it is no more than a quarter-inch above the negative. There is no need of using a diffusion or opal glass if you are planning to put condensers in your enlarger.

4. LAMPHOUSING DESIGN

Q. Does the design of the enlarger lamphousing have any effect on the quality of light it gives?—V. Drayson, North Platte, Nebr.

A. The shape of the lamphousing very definitely has an important influence on the quality of light it gives. The design of the lamphousing should be such that it provides the maximum of light through the negative; that is, it should concentrate the light and reflect it directly through the negative with a minimum light loss.

5. PRINTING ON CLOTH

Q. What is the process for printing on cloth and other materials?—C. Davidson, Waco, Tex.

A. There are a number of photographic processes for printing on silk, cloth, glass and other substances. Generally, a coat of gelatin used as a sizing agent, is applied first. The following coating may be applied to silk, linen, muslin, canvas, etc.: 10 ounces of water, 100 grains of common table salt and 20 grains of gelatin. Dissolve this mixture in hot water and uniformly moisten the textile with it. Be sure to stretch the material on a frame first. When the material is dry, moisten it again with a solution of silver nitrate, 40 grains to the ounce. The material being once more dried, is ready for printing. There are other methods for achieving the same effect—possibly with even more certainty of success. These generally use prepared products marketed by several different chemical supply firms. For further information on the same effect—possibly with even more certainty of success.

6. PARTIAL NEGATIVE REVERSAL

Q. While developing some cut film, I discovered that the image on the negatives partially reversed itself, resulting in an image somewhat like that on movie film. What caused this?—Robert Christy, Burlington, Vt.

A. Considerable over-exposure is sometimes responsible for partial reversal of a negative image into that of a positive. Frequently it is caused by the negative being exposed to light during development. When this occurs, it is advisable to check the darkroom safelight for light leaks or check for light leaks around the darkroom door. Reversal might also result from the safelight being too close to the developing tank or tray. Keep the safelight at least three feet away from where you are working. Another cause is the presence of hypo in the developer. Avoid this by keeping the trays separated during the processing and don't mix trays. Rinse trays well and mark them so that the hypo and developer trays are not interchanged. See the reference below for an article explaining the effects that can be achieved by partial reversal of negatives.

BIBLIOGRAPHY

Questions asked on this page have frequently been discussed at length in articles that have appeared in this magazine or in other publications published by Fawcett Publications. Henceforth, questions will be numbered. Corresponding numbers will be given below together with references to the articles, publications and page numbers in which the particular subjects have been discussed, if at all. This will enable readers to compile an extensive and valuable reference library on photographic technique not otherwise possible. The reference publications are all available from Fawcett Publications, Inc., Greenwich, Conn. Reference issues of Mechanix Illustrated are 15 cents postpaid. Reference issues of other publications are 50 cents each, postpaid.

1. **Table Top Photography. See "Table Top Tricks," Good Photography No. 3, Page 42.**
2. **No Image On Film. See "Develop Your Own Pictures," Photography Handbook No. 1, page 56. Also "Save Those Hopeless Negatives," Photography Handbook No. 3, page 44.**
3. **Condensing Lens in Enlarger. No reference.**
4. **Lamphouse Design. No reference.**
5. **Printing On Cloth. See "Pictures Without Paper," Photography Handbook No. 4, page 60.**
6. **Partial Negative Reversal. See "Shift to Reverse," Photography Handbook No. 3, page 20.**

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Decorative Signs For The Home Workshop

THE home workshop can be made into a more attractive place with the decorative signs shown in the photos. They offer a project which requires little skill and few tools. The captions describe the methods of construction and the photos show the finished articles. [*Continued on page 118*]

This attractive saw sign is made from scraps of pine and plywood. The blade, bandsawed out as at right, consists of a piece of ⅜ in. pine faced with ⅛ in. plywood, with letters of the same material. The handle is of 2 in. pine shaped with a jigsaw and notched to slip on the blade.

The Atom Takes A Beating!

[*Continued from page 43*]

professor, only 38 years old, was far from his laboratory even before the Nobel Prize committee recently gave public recognition to something which scientists everywhere have long realized, that the cyclotron is one of the most versatile devices ever invented for studying the constitution of matter.

He was out in the world of big business and finance arguing, explaining and planning for $750,000 to make possible the construction of this 2,000 to 3,000-ton giant. Even while this trip was in progress his laboratory already possessed two other cyclotrons, weighing 85 and 200 tons, the latter the largest in the world today and only just placed in operation within the last few months.

The huge magnet of a 2,000-ton cyclotron would be the size of a small home, 34 feet long, 25 feet high and 13 feet wide. The pole pieces of the electromagnet would be nearly eleven feet across. some 244 tons of copper would be required in the windings. In tentative plans this giant cyclotron to end all cyclotrons would be buried in a hillside near the Berkeley campus of the University of California to provide better shielding of the surrounding neighborhood from its piercing radiations.

What manner of apparatus is a cyclotron that any man has the temerity to ask for $750,000 to construct one? And what worth has such an instrument that makes other men listen with reasonable sympathy to plans calling for research funds exceeded only by those needed to found a great astronomical observatory?

The answer to that story goes back to a September day in Berkeley, Calif., in 1930, when young 29-year-old Dr. Lawrence stood up before the nation's top-flight scientific body, the National Academy of Sciences, meeting there, and explained his hopes and dreams for an almost toy-like device for accelerating charged atomic particles.

He hoped, Dr. Lawrence said, to build for a small sum a kind of magnetic and electric slingshot device that would whirl atomic particles around and around in spiral paths and, twice each revolution, speed them up by electrical "kicks."

His early plans envisioned the attainment of 1,000,000 electron volts of energy by a series of small electrical "kicks." Known first as a resonance accelerator, this experimental model shortly gained the name of cyclotron. Based on its success came a larger instrument whose magnet weighed 85 tons. Alpha particles having energies of 16,000,000 electron volts were obtained with this apparatus.

The large electromagnet of this unit was originally built during the World War for use in a huge radio transmitter which the Chinese government planned to construct. Never delivered, the magnet lay unused and eventually—with alter-

[*Continued on page 126*]

[*Continued from page 116*]

The bowl of this unique "No Smoking" sign is made of two pieces of wood turned down on the lathe, then glued together. The top is rabbeted as shown to take the sign. Shape the stem by hand, carving it with a sharp knife. Paint black and glue to the bowl. Smoke and letters are of ¼ in. plywood.

A sign of this type gets better results than a plain, abrupt one because it appeals to the reader's sense of humor.

It means what it says, even though it's said amusingly. The letters are jigsawed from 2-in. pine and attached to the base (same thickness) by means of quarter inch dowels and glue.

Silhouette of a man and his bandsaw cut from quarter inch plywood lends a realistic note to this novel membership card. The figure is glued into a slot in the 2-in. pine base. Letters are plywood of any desired thickness.

How-to-Build Bug Bites 'Frisco

[*Continued from page 47*]

The doctor at the next bench is building a mountain cabin. Each night he comes down to the shop, cuts, finishes, and fits sections of his cabin together. Saturday afternoon he lashes the week's work on his car and heads for the lake in the High Sierras by which the cabin is being assembled.

A streetcar conductor has just finished installing a new kitchen and adding a sunroom to his home, using the same plan.

The strangest job on the floor is the one an electric appliance salesman is working on. It is a trim little white colonial cottage with green shutters—designed to roll along on wheels.

The cottage will serve as a home and a traveling sales room. The salesman makes his living selling electric refrigerators, stoves, washing machines, pumps, and other electrical appliances in rural districts that have been recently electrified and are still virgin territory for his line of goods.

No door to door technique for him. His technique of sales attack is streamlined. He drives a super-deluxe trailer up to prosperous looking farmhouses. Out comes the farmer, the family at his heels, to take a look. The trailer, crammed with exciting electrical gadgets, serves as a perfect mouse-trap.

The salesman's attractive wife always happens to have just finished baking a luscious chocolate cake in the electric stove—and coffee is bubbling in the electric drip pot. The farmer and his family are invited to taste. Usually neighbors arrive on the scene. The salesman has sold as much as a thousand dollars worth of merchandize in a one night stand.

Recently, even in the back-country, trailers have become familar. Farmers are growing blasé. The salesman thinks this rolling colonial cottage is the answer to the problem of regaining their interest.

It will have real flowers in the window boxes, a tiny fireplace with glowing electric logs, and as the crowning touch—a miniature trailer tagged on behind for Mr. Mac, their Scottie.

But the plan of a retired minister really tops the list. He is working on the idea of a small submarine to crawl along the bottom of San Francisco Bay.

The undersea monster is to be used to recover a few millions of dollars worth of gold bullion and precious jewels that are said to have gone to the bottom of the Golden Gate back in the nineties when the steamer *Rio De Janiero* sank.

Husted and Jacobs are inclined to believe that it is only a matter of time before some gentleman drops in with plans for a rocket to the moon.

But for one fantastic project, fifty practical jobs are underway. Professional men, firemen, policemen and railroad employees seem to lead in numbers among the workshop craftsmen.

[*Continued on page 120*]

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These Little Pigs

[*Continued from page 55*]

individual feeding stalls for each of his little friends, and, once able to sit up to table in a calm and respectable manner, the pigs began to grow and wax healthy immediately, a condition earnestly sought in each animal by his purchaser.

And it was toward his market, the ultimate purchaser, that Mr. Eurich ever pointed. Before he had even seen a guinea pig face to face, he wrote to approximately 400 possible purchasers to discover their individual requirements. And in that way he discovered one reason for the demand being so out of all proportion to the supply. He learned that, whereas one market desired pigs so big or so fat or this sex or the other, the next market he contacted was requesting cavies with just the opposite characteristics. And, obviously, no breeder with a small brood could do more than cater to the pet lovers. If he was to break into the guinea pig big time, Mr. Eurich knew that his tribe would have to be large and varied. Pets are nice, but they just don't pay—not guinea pigs anyway.

Accordingly, even though his own brood was large, Eurich knew it was not large enough, and he increased it in a perfectly normal way. He went into the highways and hedges, among citrus growers, gas station owners, teachers, lawyers, shopkeepers, school boys—everywhere—and induced these citizens to raise a few guinea pigs. Eurich showed them how, gave them a start and became their father confessor—and, with one man raising one type of pig, another a different type, and so on, Florida soon was overrun with the pleasant chirpings of thousands of cavies, all of whom eventually went to some life-saving market, whether it be a hospital, laboratory or simple physician's office. Whenever an individual grower was able to reach his market directly, Eurich gave him aid; if he couldn't, the Svengali of the cavies bought back the stock himself.

Marketing is really quite simple. Before the piggie is 5 months old, he is ready for this great adventure. At that time, weighing from 2½ to 3 pounds, he is put into a specially constructed wooden box along with some 20 of his fellowmen. The box is enclosed with wire, some food—greens, grass, corn or carrots—is sent along to alleviate the monotony of the trip, and the whole thing goes rail express. Naturally, the animals lose some weight en route, and to counteract this, Eurich puts them on a special weight-gaining diet before leaving home—for a guinea pig is bought by the pound!

Eurich has but a few hard and fast rules for making one's fortune in the guinea pig industry. Since cavies are gentle, odorless and quiet, he thinks they make the very best of fireside companions, and are much less trouble than cows or chickens. In addition, all one has to remember is to fight for unceasing cleanliness, a minimum amount of handling, a freedom from sudden changes in temperature and a sensible diet. The animals will do the rest.

For a female pig averages from 12 to 15 young during the year; the period of gestation is about 70 days, and the average litter is three. What more could one ask?

And, for all favors granted, the cavie does more than his allotted share on this mortal coil. The modern war on syphilis sees him in there punching all the way, as the scientist can inject the blood of a human into the pig's blood, and—if the pig is free from syphilis—it will be shown beyond a doubt whether the subject has it. Furthermore, our present-day fight against pneumonia, tuberculosis, typhoid, diphtheria, scarlet fever, and many other ills, is kept at a hot pitch only because we have the cavie to help us. And, as a final gesture of his service, the guinea pig's blood even provides us with a very adequate serum for battling the diseases which he obligingly uncovers.

But, just to show you that this is anything but a purely scientific treatise, we might cite as an example Breeder Eurich's most recent big order as proof that the humble cavie also is making his way in the industrial world. A large manufacturer of glass bought 300 of the little darlings, and plans to retire them to a life of inactivity under glass. All the pigs have to do in return for their keep is to bask all day under glass of different color and texture, in order that the manufacturer can see how his products affect their nerves and delicate temperaments.

Does anybody know a better way to make a living?

How-to-Build Bug Bites 'Frisco

[*Continued from page 119*]

Dentists stand out as a type as being the most skilled with tools. The Build-It-Yourself shop is only a few months old but it is already so crowded that it is worrying about a waiting list.

The public accountant and the flyer feel they are cashing in on a natural human instinct—the fact that people have a craving to work with their hands. At times they wonder if they have touched off a new nation-wide craze that will see Build-It-Yourself shops springing up across the United States.

If Build-It-Yourself does become the country's latest fad, they are confident that it will have a far longer life than jigsaw puzzles, mah jong, or miniature golf courses—because they know it is based on a sound foundation of human nature.

Eskimos build their sleds of wood, and the runners are shod with ivory, no nails or screws being used.

Pictures, Planes, Persistence

[*Continued from page 57*]

hobby himself. Having had no previous mechanical experience, Denny thought he would never make a "go" of his new hobby, but before he knew it he was building model planes of his own design with enthusiasm.

One thing lead to another and he found himself surrounded with new-found friends, all with the same hobby. Picture commitments were not coming so thick and fast, so he decided to turn his hobby into cash. Assisting him in this new venture was a certain Mr. Baker, who entered into a partnership with Denny, and they took over an old real estate office as their workshop and headquarters.

The first two years was all in the red, so the partnership was called off. Just as Denny was about to close his doors forever, along came a young oil man, Paul Whittier, who offered to put up sufficient cash and time to put the business on its feet. Partitions were torn out of the old office, new additions were made, some $30,000 was spent purchasing materials and tools, with a final wind-up of some $75,000 representing the total layout of Denny Industries, Inc.

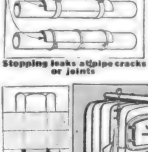
The first year of the new-formed partnership cost Denny, Inc., a loss of $25.000. Both partners admit now that had they not bitten off more than they could have chewed, they might not have suffered such a loss. What happened was that they tried to force business instead of letting it steadily increase and paying for itself on the way.

The model business is one of constant ups and downs, however. In January of last year only $48 was cleared by the shop. Since then, things have been on the upgrade. Denny has jobbed out the making of his Dennymite Airstream model motor to a local manufacturer. Of his own design, the Dennymite boasts the world's largest bearings for the size of the motor, a guarantee against faulty workmanship and an exclusive mixing valve in the carburetor for perfect vaporization at all speeds. The Dennymite is quarter horse.

Not to be outdone by his competition, Denny has contracted for the exclusive distribution of several model manufacturers, with the result that a customer may buy any sort of model plane or boat from 25 cents per kit up to special jobs, such as the government wants from him when it places an order for an especially constructed radio controlled model plane. Denny's shop is one of continuous enterprise, with bandsaws humming louder and longer as each month passes. His present equipment consists of a complete workshop with two gang saws supplemented by two band saws of the heavy duty type. Over half of the floor space is devoted to storerooms and assembly rooms where the Denny kits are boxed up for distribution. Purchases of some materials are made in carload lots, as in the case of a recent shipment of glue bottles Denny needed to complete his kits. It seems strange that their profit would not

[*Continued on page 122*]

SMOOTH-ON REPAIRS that save much money!



Stopping leaks at pipe cracks or joints

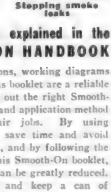
Tightening loose handles

Sealing seams or punctures in thin metal

Tightening loose bolts or nuts

Stopping boiler and tank leaks

Resetting stripped screws



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Anchoring in masonry

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Pictures, Planes, Persistence

[*Continued from page* 121]

be more as compared to their volume of business as well as the original investment, but the partners are constantly adding to their factory and importing balsa wood and the like before the war further threatens shipping. An interesting sidelight on the war situation cropped up the other day, when a Dutch freighter refused to take a cargo of model planes to France for fear that they might be construed as implements of war by the enemies of France.

Denny's partner opens the shop at nine every morning and supervises the entire shop, with Denny himself averaging two weeks out of every month in the shop. Trying to make a hobby pay along with keeping his place in the picture world makes him a busy boy. Special jobs are Denny's contribution to the Corporation. A shop in his own home keeps him burning the midnight oil over new plans and designs, with the result that his total time expended in behalf of the enterprise equals if not betters his partner's in the long run.

Correct Answers to Quiz on Page 65

1. True
2. False
3. False
4. True
5. False
6. True
7. True
8. True
9. True
10. False
11. False
12. True
13. False
14. False
15. False
16. True
17. True
18. False
19. False
20. True
21. True
22. False
23. True
24. True

25. True

Attention, MI Readers!

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Cats perspire only on the soft pads of their paws.

The Doctor Goes Down To Sea

[*Continued from page 76*]

The decision to inaugurate the Public Health "Doctor-to-Sea" service followed last year's record when sixty-two disabled persons were brought in from ships at sea off Miami by the Coast Guard.

The Coast Guard service is noted for its heroic work in saving the lives of men who go down to sea, but the nature of its ambulance service is hazardous to both rescuers and patient. Whereas small boats are used in general rescue work, mercy planes are sent out on a sick call. When these planes fare forth they find it necessary to land on whatever sea prevails at the time and take the patient from the ship under most adverse conditions.

Dr. C. L. Williams, Assistant Surgeon General, in charge of the Quarantine Division of the Public Health Service, at Washington, says:

"Our Miami Quarantine Division, with its new marine ambulance service, can take care of these emergency cases much more easily than can the Coast Guard, since their nearest small boats are based at Fort Lauderdale, forty miles up the coast."

This new service marks an interesting development of the practice of medicine at sea. In the old days the master of the vessel took care of his sick by means of a "doctor's book" which was aboard every vessel. Symptoms were studied in the light of this compendium of medical knowledge and treatment rendered accordingly. Later all ships carrying passengers were forced to carry a ship's physician, but this did not apply to commercial and smaller vessels. Then came radio.

With facilities aboard the vessel to radio to shore illness symptoms and injuries, the captain was able to receive valuable instructions how to proceed in treatment from the Public Health personnel or other sources. Now, this radio treatment is supplemented by the "Doctor-to-Sea" service and the modern marine ambulance.

Time Clicks With Tricky Ticks

[*Continued from page 61*]

The Jensens are happiest when they get some old battered clock, useless to anybody else, which they can tinker with and put into working order, with odd and humorous variations.

Being clock-makers, "time" is no object with them—some of these fantastic repair jobs have taken many months. The shop is crowded with hundreds of ancient and unusual clocks of every variety, some of them more than 300 years old. Jensen, Sr. believes that "Time" has kept him young, and is happy that his son, and his son's son, and the latter's son after him, are following in his footsteps.

If you are interested in any of the items mentioned in this issue, send a stamped, return envelope for the address of the manufacturer.

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We Broke Motorcycle Record!

[*Continued from page 38*]

of our mileage at 4:36 that afternoon, because we were figuring on another hour's run to Los Angeles.

"Something in the road ahead," I yelled to Roger. He peered over my shoulder and we both saw several men waving a red flag near some cars.

"Too late to stop now!" I shouted. "I think they're going to blast!"

I twisted my wrist and we roared past the flag-waving, shouting group at 75 miles an hour. I was just wiping my brow in relief when Roger tapped me on the shoulder.

"I think that was the finish!"

"What?" I yelled.

"I think that was the city limits. We're here!"

We slowed down and turned back. Sure enough, we had gone right by our reception committee: Floyd Clymer, an old-time Pike's Peak record holder, half a dozen cyclists, and a couple of policemen had clocked us into the city limits of Los Angeles just 4 days, 20 hours and 36 minutes after we started. We'd broken my own record by six hours.

Before I had a chance to argue about why the city limits were so far from the city (explanation: California pride) we were being escorted into Los Angeles by as hare-brained bunch of drivers as we'd ever met. It was all we could do to keep up with those professional racing drivers!

You see, both Roger and myself are strictly amateurs. We ride for fun, as do hundreds of thousands of other motorcycle enthusiasts. Weekdays I work for the New York Telephone Company; week-ends I cycle, work on engines, and relax.

As a matter of fact, that transcontinental jaunt was just a vacation for both of us. Motorcycling is the kind of sport that gets you places and gets you back, with as many thrills as you want. Airplanes go faster . . . but few amateur pilots can make low-cost transcontinental trips. Even after we'd come back to New York by the Southern route, including detours, mountains, and bad roads, we were averaging 55 miles to the gallon of gas.

Since that time one of our records has been broken by a solo rider, but we still hang on to a few, official and semi-official. Records aren't the main thing in a sport like cycling that's one-third fun, one-third driving, and one-third mechanical preparation.

When we finally unpacked our overstuffed saddle bags at the end of the 8,500-mile run, we wondered how the machine had ever carried it all. Besides two passengers of 170 pounds each, there had been a tire pump, greasing outfit that had to be used daily, extra gas tanks and fuel pump, an extra spotlight, flashlights, clothing . . . and a lot of extra tools that we might have needed but didn't; tap and dies, hacksaw, wrenches, al-

[*Continued on page 125*]

We Broke Motorcycle Record!

[*Continued from page 124*]

most a miniature repair shop ready for trouble.

When you face a high-speed run through floods, sand storms, and desert, you have to carry your own emergency equipment. That was one of the most important things I'd learned in 250,000 miles of cycle driving and 500,000 miles of auto driving. Motorcycle enthusiasts mean what they say when they argue that riding half a hundred horsepower on two wheels develops resourcefulness, caution, and technical skill.

I started my work on motorcycle engines, purely as a hobby, fifteen years ago with a successful effort to fit a one-lung engine into a home-made midget car. Since that time I've owned a dozen of various makes and several foreign-made midget cars. I've learned most about safe driving from motorcycling, no doubt with an old maxim in mind: "Mistakes on a cycle mean *you* hit the dirt." I've had spills and broken a bone or two, but I've only had one impact with another vehicle in three-quarters of a million miles of driving, and that was only a hard clashing of bumpers caused by carelessness.

Here are some cycling safety rules, most of which apply to any driving:

1. Don't go faster at night than the speed of your lights . . . meaning you must be able to stop in the distance your lights illuminate an obstruction.

2. Slow down in an unknown area.

3. Instead of relying on arm and hand signals, get into the proper lane before starting a turn.

4. Slow down when you see a trouble situation ahead (such as another driver crossing a white line), not when you're ten feet away from an accident.

5. Know exactly what your machine can do in braking, turning, accelerating, and don't put your reliance on miracles.

Tomorrow's Rocket Ship?

[*Continued from page 59*]

at the pilot's will. This may make it possible for the rocket ship to be straightened out long before it has reached the peak of its normal climb and set upon a level course. Rudimentary wings or fins would suffice to maintain level flight at the terrific speed attained. Fuel would be carried within the large gyroscopes and also in the tubular members of the double-skinned air-tight body.

Passengers would be carried forward of the motor and gyro compartments and the seats would be exceptionally well padded and deeply upholstered to offset the initial shock of ascent. Landing would be effected by releasing a succession of small check chutes to reduce the rate of fall and to assist in pulling the nose up. Then the main landing chutes would bring the ship to a slow level landing.

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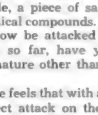

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The Atom Takes A Beating!

[*Continued from page* 117]

ations—went at the task of keeping atomic particles whirling in their spiral paths.

Out of the success of the 85-ton unit, which produced artificial radioactivity in a whole host of normally stable elements, came plans for a complete and separate radiation laboratory that would house a still greater 200-ton cyclotron.

This new unit, just completed, works so successfully that it immediately created particles having energies of 32,000,000 electron volts. With a few adjustments alpha particles having energies of perhaps 50,000,000 electron volts can probably be secured.

Ahead and beyond the range of this newest cyclotron and capable of attack only by a huge 2,000-ton cyclotron is the problem of attacking the barred domain of nuclei that defies all atomic projectiles having energies less than a hundred million electron volts. Physicists already know that such energetic particles do strange things to other atoms as they collide with them in a battering impact. In one place, in the cosmic rays, particles of this energy already exist and fleeting evidence of their capabilities are known.

But with a new 2,000-ton cyclotron such particles could be created at will and be controlled, whereas particles found in cosmic rays are rare and completely uncontrolled. Basic points of attack with a giant 2,000-ton cyclotron would be to study the enormous binding energies which link protons and neutrons in atomic nuclei and thus hold matter together into a stable form which (in much larger amounts than an atom) we recognize as a table, a piece of salt, copper or any element or chemical compounds. The proton-neutron link can now be attacked only by indirect methods which, so far, have yielded relatively little about its nature other than a rough idea of its magnitude.

Prof. Lawrence feels that with a new and greater cyclotron a direct attack on the proton-neutron force could be effected. If the nuclear forces could be understood they might well be the key to developments of great practical importance. If this nuclear force can be liberated under controllable conditions the day when the energy locked up within atomic nuclei could be released would be at hand. A brief, tantalizing hint has just this year been discovered by scientists, in the splitting of uranium atoms with the release of enormous amounts of nuclear energy when bombarded with weakly energetic neutrons.

In very recent experiments performed in Prof. Lawrence's Radiation Laboratory by Prof. Malcolm Henderson of Princeton University, it has been shown that the energy liberated amounts to 175,000,000 electron volts per atom of uranium. It takes only a bit of calculation to show that at this rate about 8 pounds of uranium would release energy equivalent to the 6,300 tons of fuel oil

[*Continued on page* 127]

The Atom Takes A Beating!

[*Continued from page* 126]

which a transatlantic steamer like the *Queen Mary* carries in her bunkers on an Atlantic crossing. The day when atomic power will become a reality is not yet at hand, make no enthusiastic mistake, but the possibilities for it are completely within the realm of reason.

Still another research possibility for a 2,000-ton cyclotron is the production of the transmutation of the elements on what would be, by present standards, a mass scale. Transmutation is possible now with present cyclotrons and its evidence can be detected by the radioactivity produced in normally stable elements like beryllium, boron and almost all the rest of the familiar 92 elements of the periodic table. But the amounts are most minute. While the alchemists' dream of transmutation has been technically fulfilled, the production of transmutation on a practical scale is far ahead.

And yet the day may not be so far off at that for it is estimated that three years of construction only would be needed to build a new 2,000-ton cyclotron. It is much more than pure day-dreaming to say that such an instrument might not only discover a new, cheap and almost inexhaustible source of power but it might (shall one say as a by-product) turn out to be the long-sought philosopher's stone—a means of transforming base metal into gold.

Harmon Hits The High Spots!

[*Continued from page* 40]

and eagerly request his skilled footwork. But 'twas not always so; Mr. Rumzie, with reluctance, will admit that his footwork was once far from skilled; clients went so far as to insinuate that they could do better themselves, which is exceptionally goading to Mr. Rumzie.

After running around in circles on some of America's finest beds, Mr. Rumzie evolved a method of breaking-in the centers of the mattresses which squared perfectly with accepted scientific principles down to the merest fraction of a logarithm. Of course, he hesitates to yield the details of his theory but he does furnish some useful information to those interested in mattress-walking. His firm manufactures hard, medium and soft mattresses which require, respectively, half an hour's walking, ten to fifteen minutes, and a few minutes for the soft grade. No mattress is too difficult a problem for Mr. Rumzie; an imposing list of mattresses-broken-in stands as an impressive tribute to the adroitness of his footwork.

"They Satisfy" is Harmon F. Rumzie's slogan for his pedal extremities and he challenges skeptics to prove otherwise.

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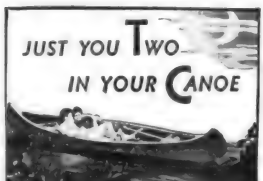

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Your Job! Aviation

[*Continued from page 7*]

wear glasses to qualify; their vision must be all but perfect. Ears are carefully checked because within them lie the canals of equilibrium, vital to a pilot. Military pilots are all free from hay fever—a pursuit plane travels more than a block during the period required for one husky sneeze. The nervous system also comes in for careful checkup.

Aviation medicine is a distinct specialty and you will be examined by a flight surgeon appointed by the C.A.A. The emphasis on physical condition is both an advantage and a disadvantage from your point of view. Any man does well to guard his health with common sense. But if you should develop uncorrectable defects, regardless of how long you have flown, you face the threat of retirement or transfer to a ground job. This is the prospect faced by most airline pilots around the age of 45. By that time, however, your experience should qualify you for well-paid jobs outside of the pilot's seat.

One final bit of self-examination: You should have definite mechanical ability, for you'll have to be as familiar with the inside of airplane engines as you are with the mechanism of your safety razor. You will have to understand the working of scores of instruments as delicate as a fine watch. If your fingers are all thumbs, that's a bad sign; if you keep the family bus ticking over neatly, like to make things requiring fine work with your hands, your mechanical aptitude is undoubtedly adequate.

High intelligence and ability to learn is indispensable; you ought to stand with the top quarter of your classmates in school. You don't take long chances just for the heck of it; if you tool a wild jalopy around corners on two wheels, scraping a fender now and then, you don't have the stability and carefulness characteristic of an airline pilot.

"How can I become a pilot?" is the burning question that has been right on the tip of your tongue.

This year the Civil Aeronautics Authority, the government agency which regulates aviation, is answering that question for thousands of aspiring pilots. They will get their private licenses this year, at a cost of $40 to each man. In five years the C.A.A. expects to turn out 100,000 licensed private pilots in a vast project of pilot training through colleges and universities.

You can qualify for this training if you are enrolled in one of the 414 colleges (and a few private flying schools) where the plan will be in effect. You will have to pass a physical examination of Army standards. Your $40 investment is a laboratory fee which includes an insurance premium. You are given ground training by C.A.A.-approved instructors, and from 35 to 50 hours of flying time in lightplanes—enough to enable you to meet all requirements for a private

[*Continued on page 129*]

Your Job! Aviation

[*Continued from page 128*]

license. If you are not enrolled in a college giving such courses, you may still win an opportunity by passing a competetive examination, in which men who have had some ground training or worked around airports stand the best chance. Five per cent of those trained may, under the law, be non-college students.

When you graduate you will be equipped to go on under your own steam to win a limited commercial license. Some graduates will be chosen by the Army for advanced instruction. If you go no farther, you will be completely qualified to operate a lightplane. Last year 1,500 stable, sturdy, beautifully performing lightplanes were manufactured in the U.S., and this year the number will be more than doubled. These ships are not much more expensive than a good automobile. As an end in themselves, they give you all you could ask for in the way of flying for sport. They also serve to build up flying time for you if you wish to become a professional pilot.

Half the airline pilots now employed are Army or Navy graduates. If you can qualify for Army training, you get paid $75 a month and are not required to remain in the service more than four years. You may, if you wish, retire with a bonus of $500 after completing your first period of active duty. If you stick for four years you will have rolled up the 1,200 hours needed for an airline license. You go through a nine months' period of intensive, full-time training. When you go on active duty you are rated a second lieutenant and draw $187.50 a month.

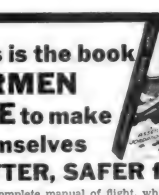
There is no finer training course available—if you can qualify. Requirements are tough. Your physical condition must be practically perfect. Moreover, you must be nervously and osychologically fitted for the job. You must be an unmarried citizen of the U.S., between 20 and 26 years of age, with two years of college and thorough mathematical background.

It costs the Army $25,000 to train a pilot. About one applicant out of eight is accepted, and 60 per cent of those never complete the course. Right now the Army has 1,550 cadets earning their wings, and the Navy has another 450 in training at Pensacola.

The disadvantage of these training methods is that you may not be able to qualify. The disadvantage of the third important method of becoming a pilot—by taking a course in a private flying school—is expense.

There are all kinds of flying schools. You can get a training course in lightplanes for as little as $60, or you can spend $5,860 completing an airline pilot's course in a well equipped school. A list of approved flying schools is available on request from the Civil Aeronautics Authority, Washington, D. C. The fact that the C.A.A. does

[*Continued on page 130*]



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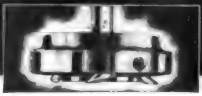

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Your Job! Aviation

[*Continued from page 129*]

Income Chart for AIRPLANE PILOT

In airplane piloting, different from many other vocations, there is practically no beginner's wage status. Only duly licensed pilots can engage in the vocation for pay, and all such pilots must have a minimum of experience before they are licensed.

Airline pilot, per month	$600 to $800
in busy months may reach	$1,000
Co-pilot, to start, per month	$180
Co-pilot, year's experience with company, per month	$250
Commercial pilot	Indeterminate; some men may make as much as airline pilots, others have hard time making a living.

not list a specific school does not necessarily mean that it is inferior, for ratings are issued only at the request of the schools themselves, after government inspectors have examined them. But it is only common sense to study the catalogues of various schools, note what equipment they possess, the courses they offer, their affiliations, and then make a hard-headed decision.

Here is an average cross section of what is typically available from reputable schools for your money:

A two months' ground school course plus 25 flying hours, $435.

A twelve months' course to prepare you for a commercial license, $2,800.

If you already have a commercial license and 400 hours of air time, a six months' course for airline pilot rating, $2,760.

And airline pilot and operations course, including 260 flying hours, running eighteen months, $5,680.

To these costs must be added living expenses during the period of training. There are many other combination courses in addition to those listed, of course. Some types of aviation work can be studied to advantage by correspondence, but it is of course impossible to become a pilot without actual flying time. When you're in a tailspin you don't have time to hunt around for a lesson sheet telling you how to get out of it. Engineering courses, however, can advantageously be taken by correspondence, especially if you are building up flying hours a few at a time and want your ground work to keep pace with you.

A good many flyers of tomorrow are getting air time in just that way, saving up until they have enough money to buy a few hours. Dual instruction in medium size planes costs, on the average, about $15 an hour. Solo time, once you

[*Continued on opposite page*]

Your Job! Aviation

[*Continued from page 130*]

are qualified, may be had for less, but usually not under $5 an hour—generally more.

Expensive? Well, flying training doesn't come for chickenfeed. But a doctor has to invest at least $10,000 in his training, and he doesn't start to earn anything until he's thirty years old. A top-notch airline pilot has a professional degree at least equivalent to an M.D., and during the course of his career he's responsible for more human lives than the average surgeon.

"How does a pilot get a job?" you are wondering.

There is no standard answer. Your school—perhaps affiliated with a transport company—may recommend you. You follow the rule of all job-hunters: go where the jobs are. They are likely to be concentrated in regions of dense population. Your first job at an airport may not be very impressive. No matter. You're getting a chance to show your stuff. Once you have the necessary licenses, aviation executives will be glad to give you a hearing. You have already proved yourself by passing government tests. It is out of raw material like you that tomorrow's pilots will have to come. A pilot is accustomed to standing on his own feet or he just isn't a pilot.

Next month we will discuss the vocation of aviation mechanic.

BALANCE SHEET

Advantages and disadvantages of the Airplane Pilot's Vocation

ASSETS	LIABILITIES
Income is good to excellent	Impracticable to start own business
Paid while learning if you can meet Army or Navy standards	Changes in health may force retirement
Occupation highly regarded by the community	Pilot usually transferred to other jobs around age of 45
Splendid stepping-stone to important aviation jobs, particularly if combined with engineering training	College graduation a practical requisite for choice jobs
Industry is expanding with great rapidity	Private training costly
Possession of licenses testifies to skill and experience	Physical strain great
Thrown in contact with outstanding men	Employment standards extremely high
Travel and change of scenes assured	Government qualifications exacting
Technical developments will augment rather than decrease opportunities	Living conditions unsettled during early years on job
Work is extremely satisfying to the average temperament	Opportunities not evenly distributed geographically; centered in large cities
	Hazards to life and limb greater than in most occupations
	Demands intelligence above average

THE OCCUPATION CAN LEAD TO:

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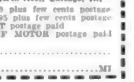

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Tuning Up The Put-Put

[*Continued from page 97*]

effect, allowing free transfer of energy from primary to secondary but not the reverse.

Explained thus, it can be seen that the magneto is indeed a simple device, although like any similar development a great many years of intensive research have gone into bringing it to its present state.

The greatest enemy of the outboard magneto, or for any other spark-producing device for that matter, is dampness, especially that dampness arising from proximity to salt water. It permeates the high-tension wiring, works its way into the windings of the coil, destroys the insulating qualities of fiber washers and bushings, and allows the high tension current to leak down the porcelain of the spark plugs. Broken, worn or cracked insulation on the high tension leads is another common trouble, as is dirty or worn breaker points. Rectification or avoidance of these faults is all that is necessary to insure efficient operation of the magneto.

Like any machine, including the human, magnetos give warning of anything wrong with their in'nards; the magneto's equivalent to the human's bellyache might be a skip or miss in the operation of the motor, progressively harder starting each time it is used, or even a total cutting-out on one cylinder. And, like the human again, early diagnosis and remedy saves a great deal of future trouble and expense. Thus, at the first sign of trouble, the magneto should be checked and any slight faults corrected before major difficulties develop. Any owner with a bit of mechanical aptitude can do this, and it is only when a total breakdown, either through neglect or submersion, takes place that a specialist is necessary.

Suppose your engine has been "acting up" and you suspect the magneto. Take out the spark plugs, ground one high tension lead, hold the other a quarter-inch away from some part of the engine and spin the flywheel with a nail or punch held in the starting cord notch. A crackling blue spark should result. Do this on both leads, if the engine is a twin. Perhaps the spark is yellowish in color; this is usually due to improperly set or dirty breaker points, or perhaps cracked and dried out high tension leads. An occasional adjustment is necessary on the points to maintain the gap at proper clearance and thus assure a maximum intensity of the spark. On a majority of motors built up to two or three years ago the points can be inspected and adjusted by removing the starter plate from the flywheel, exposing an inspection hole in the flywheel proper. When the flywheel is turned to where the points can be seen, the points can be opened and closed by shifting the flywheel an inch or so in either direction.

The points should be thoroughly cleaned with a strip of No. 00 sandpaper doubled back on itself to present a sanded surface to each point. Any

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Tuning Up The Put-Put

[*Continued from page 132*]

sand left in the process should be removed by drawing a slip of heavy paper between the points. The points should face each other squarely, making contact all over, and the clearance between them in their "open" position should be .018.

The procedure for setting clearance varies with the type and make of motor. Sometimes the whole breaker assembly is moved back and forth, shifting the breaker arm which bears against a cam in the flywheel hub. In this type the screw, or sometimes two screws, which hold the breaker assembly to the armature plate are loosened and the assembly pivoted around until proper clearance is obtained, after which the screws are tightened and the gap re-checked. In other types the point itself, set on a threaded mounting, is screwed in or out, with a locknut to hold it in proper position. Particular attention must be paid to having the points square with each other in this type, even if considerable filing is necessary.

Lately, general practice has been to omit the inspection slot in the flywheel and to use a flat-way machined on the crankshaft to close the points rather than a cam on the flywheel hub. In such case it is necessary to remove the flywheel, after which work can be done as described above. Adjustment is easier in this type, as the adjusting screws are more accessible with the flywheel off. In another popular make, a set screw is loosened, the plunger bearing against the crankshaft is pushed until the points are open the required amount and the setscrew tightened again.

A word of warning here: If the flywheel is removed for any reason it is imperative that it be put back tightly. Turn the nut down as firmly as possible, then rap the end of the wrench sharply with a hammer. Do this several times until you are positive the tapers are tightly seated. A loose flywheel can cause troubles ranging from constant breaking of shear pins to tearing out the crankshaft and flywheel keyways, or even breaking off the tapered top of the crankshaft on which the flywheel hub seats. So make sure it is tight, and check it at intervals during the season to assure yourself that it stays that way.

But to get back to the subject: If cleaning and setting the points doesn't improve the quality of the spark, or if no spark can be had at all, the magneto must be removed from the motor and further testing done. Simple test equipment can be readily made up for the purpose; for coil testing only a couple of pieces of wire and a storage battery are needed, as per the diagram, and the condenser is likewise simply tested with the circuit shown. Always test the complete armature first, then the individual parts.

Only two cells of the storage battery are used, giving 4½ volts for the test. Hook up the battery as shown, grounding one high tension lead back to the armature plate and holding the other about a quarter inch away from the plate. Flip the

[*Continued on page 134*]

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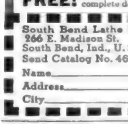

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Tuning Up The Put-Put

[*Continued from page* 133]

points rapidly by hand, and a hot blue spark should result. Try both sides. In some cases, where the coil and high tension insulators have become damp, the spark will jump from the coil connections direct to ground, short circuiting the high tension leads. The remedy is obvious; wash off the plate with gasoline or carbon tetrachloride (fire extinguisher fluid), which will remove the moisture.

The next step, providing dampness is not the cause, is to disconnect and test the condenser. Use the circuit shown, holding one test lead to the body of the condenser, the other to the flexible lead. Make the connection, hold it for a second or so and then short the lead back against the case. A distinct snap should be heard as the condenser discharges, showing it to be in good condition. No discharge denotes an open-circuited condenser, and of course if the lamp in the test circuit lights the condenser is shorted.

The amount of current in the primary circuit when the magneto is in operation is necessarily very small, and any leakage is therefore highly detrimental to proper operation. A source of trouble in this respect is the button and contact used to stop the motor. The contact is usually insulated from the armature plate proper by means of fiber washers and a fiber bushing where the contact passes through. Corrosion and dampness affects the insulating qualities of the fiber, especially when the motor is used in salt water. If this fault is suspected the wire leading to this contact should be disconnected and the plate tested again with the battery; if it tests o.k. with the wire disconnected, take the contact assembly apart and dry the fiber thoroughly, using gentle heat.

Fiber washers are used to insulate the "live" breaker point, too, and the same procedure of drying should be resorted to if no spark is produced after all the above steps have been taken. Make sure the assembly is put together exactly as it was, else the point is apt to be thoroughly grounded after reassembly.

It sometimes happens that when an armature plate is removed, it is found to be covered with a film of oil. This is because the upper bushing in the crankcase is worn, allowing the escape of some of the fuel mixture which passes through the crankcase on its way to the combustion chambers. Leakage at this bushing, incidentally, is often the cause of hard starting. This oil will very often seep into the space between the post holding the pivoted breaker point and the body of the breaker blade, causing a poor ground. It will work between the points, with the same result, and if there is dirt or dust on the plate or any of its parts it will cause partial short circuits. A thorough cleaning with gasoline or carbon tetrachloride will overcome this, although

[*Continued on page* 135]

Tuning Up The Put-Put

[*Continued from page* 134]

sometimes it is necessary to take the point assembly apart, clean each separate piece, and reassemble.

One component which the owner always suspects first when the magneto gives trouble and yet one which is seldom at fault is the permanent magnet installed in the flywheel rim. This very seldom loses its magnetism to any appreciable extent unless badly abused by dropping, hammering, etc. It can be given a rough test simply by holding a screwdriver or pair of pliers near the pole pieces, noticing the amount of drag exerted. As long as there is a noticeable amount of pull it can be presumed the magnet is in working condition.

With the series of tests outlined here it should be possible to determine exactly where the magneto is at fault, and of course the remedy in each case is obvious. However, when all else fails it is time to put the magneto in the hands of a specialist; he will have the sensitive testing equipment and the first-hand knowledge necessary to determine exactly where the trouble lies. But bear in mind that seldom indeed does an outboard magneto go bad without apparent reason or some definite warning, and it is better to go through the procedure given here than to assume at once that a major overhaul is necessary. So proceed slowly and methodically, keeping in mind the inherent simplicity of the magneto, and you will generally find some minor little trouble which you can easily rectify yourself.

Two Yacht Wheels

[*Continued from page* 81]

trays, etc. Spokes are lathe-turned, and the rim is made up of 60 degree segments cut on the scroll saw, then assembled with casein glue and brass screws. Finish with stain, filler and two or three coats of top grade spar varnish.

Substantial Yacht's Wheel

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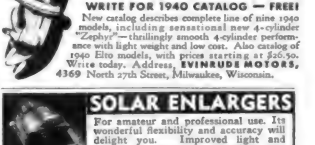

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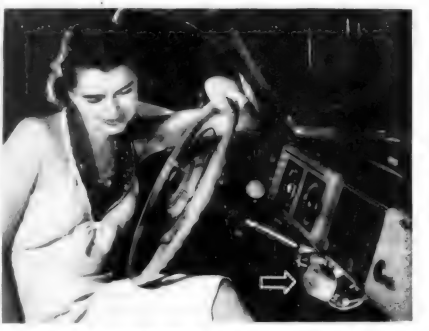

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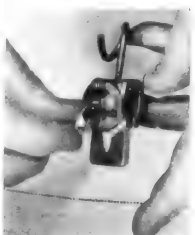

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BUILD your own Electric Welder for operating from storage battery. Simplified Plans and 1940 Catalog 10c. LeJay Manufacturing, 614 LeJay Building, Minneapolis, Minnesota.

Build The Electra

[*Continued from page* 89]

awning are fastened to the roof. The dinghy is carved as shown and attached to the cabin top after the model has been painted.

Installation of the navigation lights is the next step. The drawings show the procedure plainly, and illustrate the wiring system for the operation of the lights.

After masking the cabin sides and deck of the craft with masking tape, several coats of primer are applied to the hull. Sandpaper thoroughly after each coat has dried, making certain a smooth, almost glass-like surface is obtained. Pumice and rotten-stone may be used to wear down the final coats of primer. Allow the surface to harden over a period of 12 hours before spraying the ship.

Lacquer is used to color the hull. White sides and marine green bottom make an attractive and shipshape color scheme. If sprayed, a working pressure of not over 50 pounds is used. If painted by hand, it will be advisable to use a four-hour enamel rather than lacquer.

The deck is to be stained mahogany as are the strips cemented to the roofing. The mast, dinghy, and windbreakers are also mahogany stained. Cabin roofing is colored white.

Details such as the side windows, curtains, etc., are now cemented into place and the model is completed.

A high polish may be given the hull by the use of auto wax.

To operate the model the orthodox method of starting the motor is used. The craft is not designed for high speed runs or racing, therefore, it may be allowed to sail free. If the builder desires, a timer may be used to control the limit of the run. Usually, it is advisable to permit only short motor runs in order that the model be easily retrieved.

A diligent inspection of the motor unit, wiring, fittings, etc., is to be encouraged before and after each run. In this manner, trouble may be detected before it has opportunity to become serious and the upkeep of the craft is reduced considerably. Constant care will keep the boat looking sleek and new.

Blueprints for *Electra* drawn to approximately half-scale are available at $1.50 postpaid. Send check or money order to Fawcett Publications, Inc., Greenwich, Conn. Order by number (319) and be sure to print your name and address clearly.

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Why Lines Are "Grounded"

[*Continued from page* 101]

a socket, with two short pieces of well-insulated wire from the latter. Touch one wire to the cut-out box, receptacle box, cable, etc., and the other to each of the power wires in turn. The lamp will light only when the black wire of the new circuit to this side; the white wire goes to the other side, which is the grounded one.

Incidentally, a little probing with the test lamp on floor lamps, radio sets, irons, fans, etc., may reveal partial leaks in these appliances. Look them over thoroughly for evidences of broken insulation, exposed strands of wire brushing against metal parts, frayed or broken insulating bushings or washers, etc.

Contrary to general belief, the metal chassis of radio receivers are not always grounded; in many cases they "float" electrically well above ground potential. This explains why fireworks take place unexpectedly when certain receivers are placed accidentally against radiators. Some sets of the a.c.-d.c. type, which have no transformers to isolate the power line from the radio circuits themselves, absolutely must *not* be grounded, and the warning label to this effect unfortunately escapes the attention of handy men who have read somewhere that a good ground helps bring in more stations, reduces line noises and eliminates hand-capacity effects. If the usual non-polarized plug happens to get into the receptacle the wrong way, the extra ground connection places a dead short circuit across the line. Altogether aside from this trouble, the unnecessary "ground" is likely to cut out part of the essential power supply within the receiver itself.

Woodpecker Door-Knocker

[*Continued from page* 91]

in incision and halfway down insert nail through feet and incision as an axle. Attach chain from bottom of feet, allowing it to come out at the bottom of the hickory through the groove. A chain or braided grass or cord would be more becoming than one of iron. A twig with bark off is attached to the chain with eyelet screw for an ideal pull. Exposed parts of wood are painted in aluminum to prevent rot and the woodpecker in aluminum, black and white. The pine base is then nailed beside the door.—*C. H. Burgess.*

Water Level Control For Well

[*Continued from page* 90]

quire only a short float movement. Hence, stops should be inserted in the dowel rod to limit its travel. System C, however, calls for a float movement equal to the depth of the water at high level. And also requires a series of additional switches located one above the other. These should be mounted on extra guide-blocks equally spaced, and the frame lengthened to suit.

Common two-by-two and two-by-four lumber will serve the purpose if the system is used only for a couple of months during the dry summer period when there is constant danger of pumping the well dry. For continuous year-round service, though, a water-resistant wood, such as spruce or cedar, should be used. It is also advisable to impregnate the float and float-rod with melted paraffin and use brass screws through-out the construction. Breaking the rod into 3 ft. lengths and joining the sections with universal joints made of screw-eyes will insure smooth action of the float even if the rod should warp slightly.

The water-level meter (System C) can be any battery voltmeter. To make for easy reading, however, its dial should be altered to read from right to left in equally spaced figures. The resistance units that couple the switches in the well can be made up of lengths of resistance wire of suitable gauge. Wire salvaged from discarded radio filament reostats will do. With the float at the lowest level all the resistance units are cut out of the circuit. This total absence of resistance should cause a reading of 1 on the altered dial (or full-battery voltage on the unaltered dial). Position 2 of the float cuts the bottom resistance unit into the cricuit, bringing a reading of 2. Float-position 3 increases the resistance by cutting in two units, bringing a reading of 3, etc., on up until the float has reached the high-water level with all the resistance units cut into the circuit.

Care should be taken to make the contact band on the rod long enough to span any two adjacent switches, so that in passing through one into another there will be no break in the circuit. Otherwise, with the float at intermediate levels, the meter would show no reading. A switch should be located at the meter to break the circuit after a reading has been taken.

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How To Make A Farm Trailer

[*Continued from page* 93]

(dependent upon the size rack planned that is) and bend them together to meet at the hitch. A metal hitch plate is introduced at the joint as shown in the drawings and a single bolt is used to bring the ends tight together. Spot weld the seams and a simple rugged hitch results. Note how the ends of the frame and the hitch plate are cut out to engage the tow bar.

As a front axle is used some means must be employed to secure the wheels. Either of the methods illustrated is satisfactory but whatever the means employed it is essential that the wheels be lined up exactly before securing. Otherwise the trailer will not track properly and besides constituting a menace to traffic will prove unduly hard on tires. Some states require an additional hitch for safety purposes. This is a good idea and merely requires a few feet of stout chain or stranded steel cable to effect. Attach the chain or cable to the frame members where they begin to bend towards the hitch and secure the ends to the tow bar with steel snap hooks.

The easiest way to attach the body work is by bolting 2 x 4-in. sills or stringers to the outside of each frame member. The sills should be set with the top edges flush with the top of the frame. Build the box or rack on top of these sills to whatever dimensions you desire and which your frame permits. Ordinary wagon type construction is probably the best for the purpose besides permitting the use of old parts such as strap bolts, angle iron, etc.

If you can dig up an old pair of rear fenders these are ideal. Heavy galvanized sheet bent to suit forms an excellent substitute, and in any event the fenders are easily attached to the body with strap iron supports. The entire job should be given several coats of good weatherproof paint, both inside and outside, and underneath. Taillight, etc., are minor details easily worked out by the builder.

"Blueprints" Made Easily

[*Continued from page* 102]

must face the back of the drawing, so that the print won't come out as a mirror-image. Placing them face to face will result in a mirror-image, if it is desired to use such a print as a negative for making black-on-white prints.

It isn't necessary to have a large printing box to make large prints. The enlarger can be used for this purpose by holding the papers in contact under a heavy piece of glass, and allowing the light from the projection lens to shine through the latter.—*M. T. Backer.*

King Henry the First of England decreed that a yard should be the distance from his nose to the end of his thumb.

Glass-Top Tables

[*Continued from page 107*]

Rub down with a rag briskly to insure a smooth surface.

The pipes are 1-in. in diameter and 19-in. long. Drill a hole through each near the bottom end and tap in a stiff wire or nail to provide anchorage in the concrete. Mix a mortar of 2 parts of screened sand and 1 part of Portland cement, add just enough water to make the mix barely quaky. Fill the form carefully, sliding a trowel or knife blade up and down around all edges to work air bubbles to the top. Set the pipes in place, spaced as shown, and to hold them plumb and in place, fasten wood strips from the tops of the pipes down to the edge of the form until the concrete has set. In 24 hours remove the form and carefully fill any air pockets with neat cement, troweled smooth. Now set this slab in a damp place where it will not dry out for another 48 hours. By this time the concrete has set thoroughly. Then place it on top of the furnace and speed up drying as much as possible. This should be kept quite warm at least a week. To complete the base, give it a couple coats of gray cement paint and then two coats of either aluminum paint or bronze paint to match whatever type of pipes you used.

The simplest way to anchor the suction rubber cups is to drive a hardwood plug into the top of each pipe, saw off any protruding portion, then bore a small hole in the center into which the brass, threaded stud of the cup can be screwed.

Glass-Metal-Wood Occasional Table

A neat, light, useful and ornamental table in any home. The top is simply a disc of plate glass 20-in. in diameter while the base is formed from a smaller disc of any hardwood. The legs are exactly the same design as those employed in the masonry table and are 17-in. in length.

Have the glass top cut and the edges ground or bevelled. The base is turned from 2-in. hardwood, drilled for the three pipe legs and then sanded, stained and waxed.

Mirror Top Occasional Table

A pleasing modern design which is simple to build and calls for no special tools. The top is a 20-in. disc of good mirrored glass with the edges ground. The base or stand is constructed of three legs, 1x3x17-in. The legs are notched to receive the circular top and notched again 3-in. above the foot to receive the 1-in. thick shelf. The 20-in. diameter shelf is let into these notches and braced with brackets as shown. Joints are made with long headless nails and can be further strengthened by setting in casein glue. The outside edge of each leg should be planed to conform to the radius of the table top. The inside edge of each leg is left flat.—*Dale Van Horn and Douglas Rolfe.*

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For Better Finishing

[*Continued from page* 113]

Use a shade to match the stain used. The filler is put on with the consistency of a cream and allowed to set until it turns rather white, then rubbed off with a rag cross grain. Be sure to clean out all corners before the filler sets hard. Allow about twelve hours to harden.

It is better to apply many thin coats than one heavy coat of shellac. Do not go over the surface any more than is necessary, to avoid laps. Do the shellacking in a warm room, free from drafts. Three or four coats give the best surface. Lightly rub between coats with No. 00 sandpaper and the final coat with pumice stone powder and crude oil, using a felt pad for this operation.

Varnishing—

Before the application of varnish, all work should be thoroughly cleaned. This, though simple, is important, as small pieces of dust become large humps and blemishes after a few coats of varnish have been applied. For best results, use two brushes, one for the preliminary dusting and one for finishing. The brushes should be thoroughly washed with soap and water before using to insure their cleanliness. Allow sufficient time for dust to settle before varnishing.

Have enough varnish so that the brush tip will not touch the bottom of the vessel containing this liquid. Dip the brush into the varnish carefully, so that unnecessary action will not create dust that will fall on the work. Spread with an up and down movement and then cross with slight pressure, finally finishing with an upward stroke. Before giving the finishing stroke, the brush should be freed of all excess varnish, otherwise the surplus material may ooze onto the work and an even finish will be impossible.

The first coats of varnish used can be of a dull finish which after each application can be rubbed smooth with a felt pad and pumice stone. Water or rubbing oil can both be used, in conjunction with pumice. If water is used, dampen the surface of the work with a sponge, then sprinkle a little pumice on the felt pad and rub the surface gently. More water and pumice is added as the operation demands. When oil is used, follow the same procedure.

Wax is used on either stained or unstained wood. The finishes given by wax are very satisfactory. If the work has been stained, be sure that the surface is dry before applying wax. To apply wax, put it on a flannel cloth or place a lump of it in a pad of cheesecloth and rub the surface until it is completely covered. Then polish to a hard glaze with a sheepskin polishing pad attached to a flexible shaft; or this operation can also be done by hand. The result will be a sort of dull, satin finish which is hard and durable. Increasing the applications will give greater depth to the finish.

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Wax finish can be applied on close-grained wood, such as maple, after a coat or two of shellac has been applied to seal the pores. Spread wax with cheesecloth, then buff down to a hard, satiny surface. Each succeeding coat of wax (up to about four) will improve the finish.

The best woods for antique finishes are the open-grained woods, as it is easier to make their pores look gray, as with accumulated dust. The stock should first be stained, given two coats of shellac and sanded down after each coat. Then mix two parts paste wax with one part rottenstone, rub this mixture well into the pores of the wood and polish.

Lacquers have many advantages for finishing—they are tough and durable, and most of them dry in ten to fifteen minutes, leaving a dust-free surface. They can either be sprayed or brushed on. If applied with a brush, use one with soft, long bristles. Do not try to brush too long, or try to cover too large an area at one time. Allow about an hour between coats for drying. If lacquer becomes thick, it should be thinned with a lacquer thinner. Two or three coats are usually sufficient to give very satisfactory results. Lacquer should never be applied over mahogany stained work, or recently varnished, painted, or enameled surfaces.

Now . . . Craftsmen, after this resume on various types of woods and how to finish them, you will see how important the charts have become. If followed, your work will take on a new appearance, your next project will look professional in appearance and will be a pride to exhibit!

FEATURED NEXT MONTH

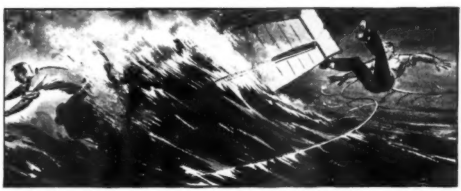
Like to do a little archery with a new twist? Then watch the May Mechanix Illustrated so you can build the simple powerful *crossbow* described in the How To Build Section. Made with an old auto spring leaf, this bow will shoot arrows or bolts with great accuracy.

"THE HEAVY LINE DRAGGED ME TOWARD ETERNITY!"

A true experience of C. J. LATIMER, *Warren, Ohio*

"ANOTHER FISHERMAN and myself had just finished setting a heavy trot-line in Lake Erie," writes Mr. Latimer, "when a sudden treacherous squall lashed out of nowhere and churned the water into towering waves.

"A WAVE SMACKED us broadside, and over we went! Then I felt a heavy drag on my leg. I was caught in the trot-line and was being pulled to my doom. In the darkness, my companion couldn't untangle me!



"BUT ONE OF OUR PARTY ON shore brought his flashlight into action. Its powerful beam cut the distance and darkness—and in a minute I was free. I shudder to think of what might have happened except for those dependable 'Eveready' *fresh* DATED batteries!

(*Signed*) C. J. Latimer"

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